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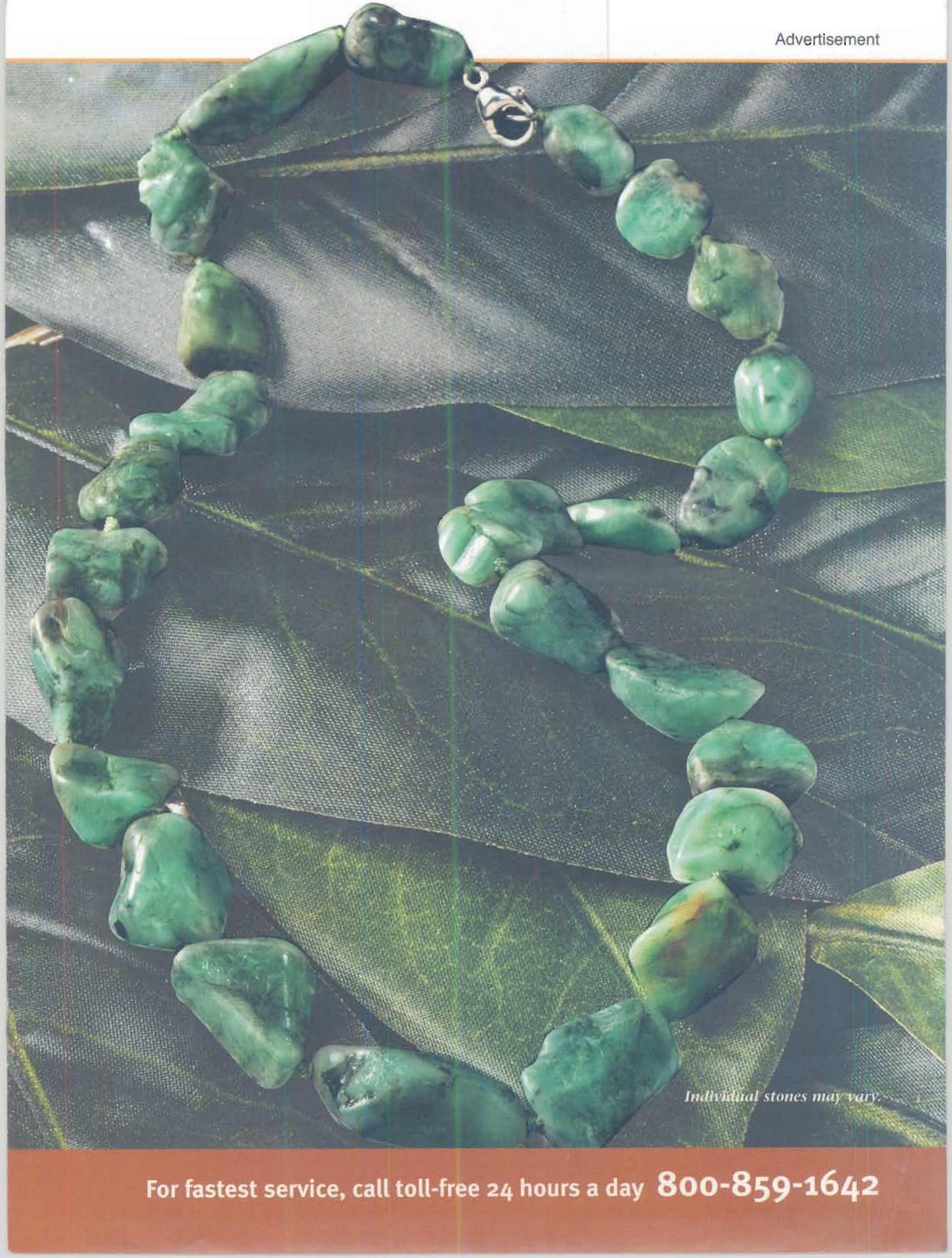

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October/November 2007 | Vol. 22, No. 5

AIR&SPACE Smithsonian

ON THE COVER
The coal-black X-15 that hangs in the Smithsonian's National Air and Space Museum comes menacingly to life in Eric Long's portrait – and seems to embody the muscular beast that test pilot Milt Thompson likened it to: a huge, black bull.

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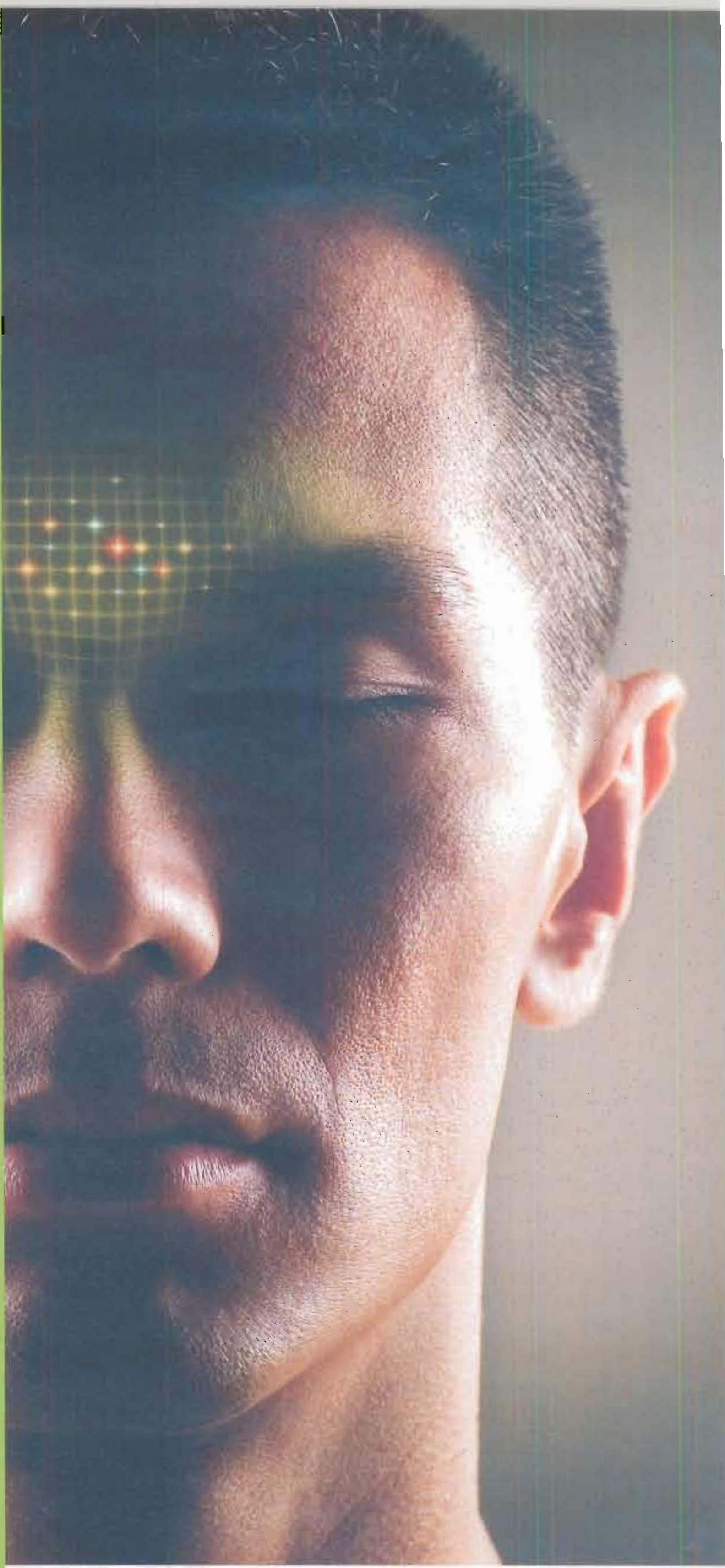

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America by Air

ALMOST 90 YEARS AGO, on May 15, 1918, Army Lieutenant George Boyle fired up his fragile Curtiss JN-4 trainer and trundled down a polo field in Washington, D.C., just south of where the Lincoln Memorial now stands, in front of a crowd of dignitaries including President Woodrow Wilson. As the little biplane clawed upward with its cargo of mail destined for New York City, the U.S. Air Mail Service was born. Unfortunately, Boyle lost his way and flew south instead of north, landed in Waldorf, Maryland, and nosed over. Despite this awkward start, the Post Office expanded air delivery and, within three years, was reliably flying tons of mail quickly across the country.

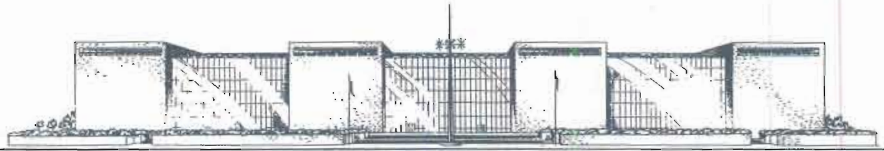
Most people have no idea that this lowly little flight started America's airline industry. Earlier attempts to carry passengers came and went before the Post Office made air travel possible by creating the routes, developing the infrastructure, and paying for the industry through contracts and judicious subsidies. By the late 1920s, these routes were turned over to commercial airmail carriers—forerunners of today's airlines.

On November 17 we will open a new exhibition, entitled "America by Air," in our Hall of Air Transportation. It will tell the story of how the U.S. air transportation system came to be what it is today. In its early days, air travel was held back by primitive technology and organization. But with the advent of government support, it became practical, safe, and profitable. The story is divided into four parts: The Early Years of Air Transportation, 1914–1927; Airline Expansion and Innovation, 1927–1941; The Heyday of Propeller Airliners, 1941–1958; and The Jet Age, 1958 to Today. In each part, visitors will learn about the aircraft and engine technology of the period, as well as the people of the industry, the passenger experience, improvements in safety, and the governmental framework.

Through careful design, the exhibition will encourage visitors to move from section to section, where they will see engines, aircraft, uniforms, instruments, timetables, posters, and numerous other artifacts from our collection that had not before been on view. Interactive displays will help visitors experience the noise and vibration of a 1920s Ford Tri-Motor, the luxury of travel on a Douglas DC-7, and the computer technology of a contemporary Airbus A320 cockpit. Dominating the new exhibit, a forward fuselage of the giant Boeing 747 will be a two-story attraction that visitors will be able to enter and view from the upper deck.

Flight has released us from geographical limitations and revolutionized the world. We hope that "America by Air" will help convey the excitement and importance of air travel for decades to come.

■■■ J.R. DAILEY IS THE DIRECTOR OF THE NATIONAL AIR AND SPACE MUSEUM.



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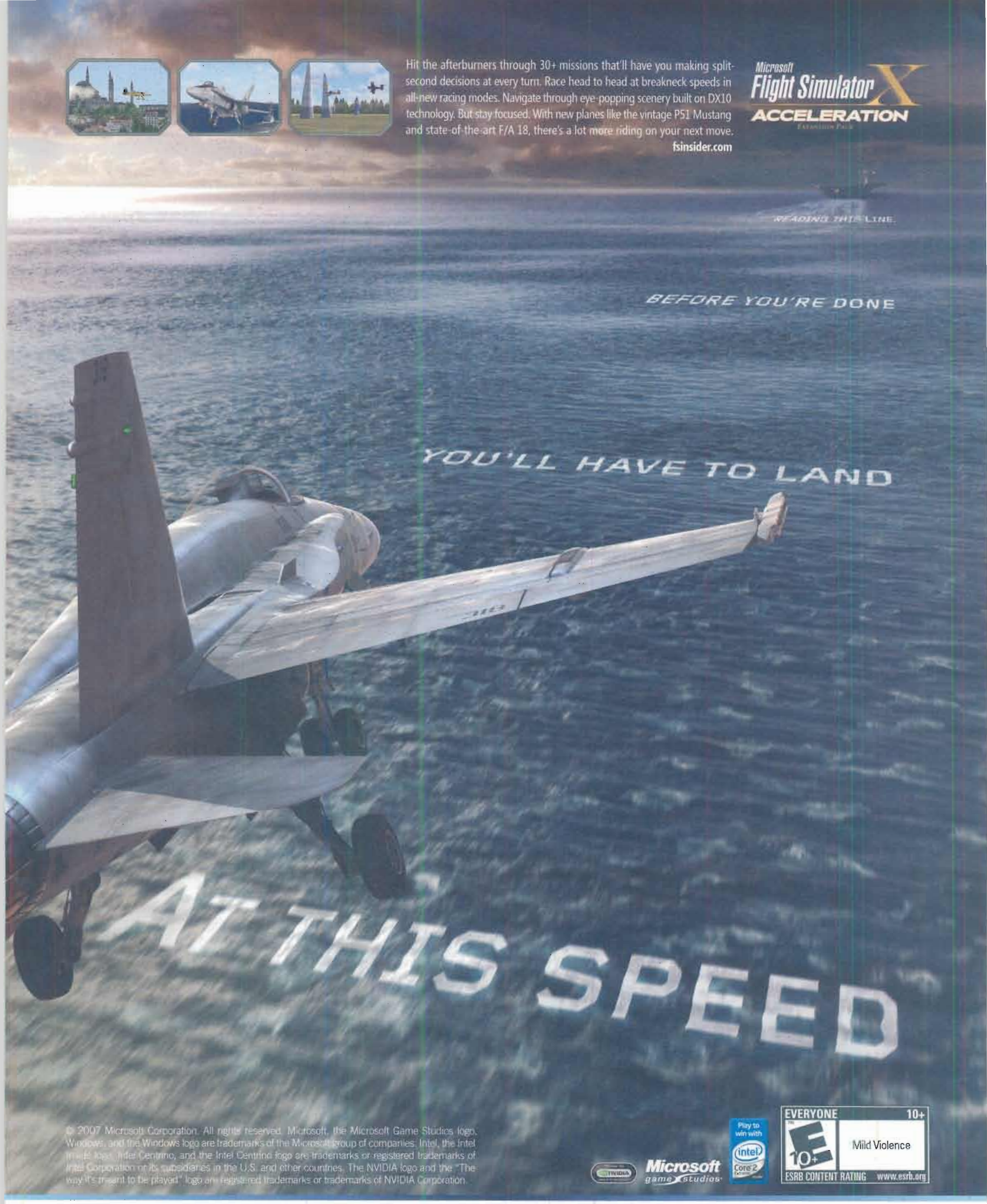

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Letters

WRITE TO US

Fight Back, Flight Attendants!

I was a flight attendant from 1976 to 1989, and during that time we dealt with hijackers, disruptive passengers, emergency landings, administering oxygen, and distributing meals, sometimes in a short flight time. I concur with the policy of teaching flight attendants to defend themselves and the aircraft ("Coffee, Tea, or a Knuckle Sandwich?," Then & Now, Aug. 2007). If, back in the 1980s, flight attendants had been allowed to hit a hijacker over the head with a fire extinguisher, the message would have been sent that Americans do not tolerate this behavior.

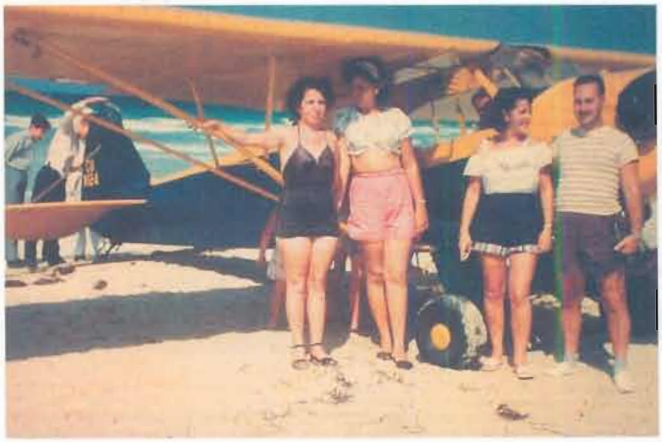
Catherine Snow
via e-mail

Mystery in Cuba

I had to leave Cuba in 1960, when I was only 10, and I wish I remembered more of the details that were recounted in "The Country Where Nobody Flies" (Aug. 2007). Rafael Lima describes carefree flying days when Cuban pilots could land on one of the island's many beautiful beaches. This may explain a photographic slide my father has, one which made it into exile (below). The slide depicts an unknown Cuban aviator who had landed his Piper J-3 Cub on Boca Ciega beach, east of Havana, circa 1948. The photograph was taken by an uncle, Fernando Prego Sr. My parents are to the right; Mr. Prego's wife—my aunt Josefina—is to the left. The pilot may have decided to take a sightseeing break, although to this day my father says, "There was something wrong with the plane's propeller." Perhaps the flier of Cub no. CU N124 is still around and will explain if he or she ever sees this image?

May free Cuban wings soon grace the skies over that beautiful island.

Albert Quiroga
Boca Raton, Florida



Fun in the sun: a sweet scene from Cuban aviation in the 1940s.

The LeMay Way

Joe Pappalardo's review of *LeMay: A Biography* (Reviews & Previews, June/July 2007) was most kind. In the 1950s, I was assigned to Offutt Air Force Base in Nebraska. I periodically had to pull duty with a staff duty officer, overnight, in Strategic Air Command headquarters. While making my rounds one night, I opened an office door and realized I was in Curtis LeMay's office in the Command Section—the office with bulletproof windows and Air Force Blue carpeting about two inches thick. I quickly left via another door and caught hell later, since the cleaners had to go back and vacuum out my footprints so that LeMay wouldn't see them the next morning.

While walking on the base, one had to salute the new Buick staff cars the generals used. If you ignored the four stars on LeMay's, you could easily end up in French Morocco.

Your review didn't mention the Strategic Air Command's B-36 Peacemaker. It was our first intercontinental bomber, and I firmly believe that when flights of

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them were going 24/7 during the early years of the cold war, they kept us safe. I can still hear their awesome drone, and am sad that they are being forgotten.

E. Duane Meyer
via e-mail

Tale of the V-Tail

"A Bonanza Anniversary" (In the Museum, Aug. 2007) implies that the Beechcraft Model 35 Bonanza was designed with a V-tail because such a structure was lighter than a tail with conventional vertical and horizontal stabilizers. The V-tail not only saves weight, it is aerodynamically superior to the standard three-surface design.

Furthermore, the article says that after the Bonanza was introduced, the V-tail was modified "after several accidents related to control issues." More than 10,000 V-tail Bonanzas were sold through the early 1980s, and a majority are still in service. As for tail modification, the Model 33—the Debonair—which has a standard tail form, was introduced in 1960 as a less luxurious, cheaper, and, it was hoped, entry-level aircraft. To suggest that this option was dictated by safety issues is erroneous and irresponsible, and slanders a superior design.

William R. Beech
Tiburon, California

Editors' note: The writer is the nephew of Beech Aircraft Corporation founder Walter H. Beech.

The passage of the article about the straight-wing modification refers to the 36, not the 33. In any case, we should have said that the accidents led to a change in product line, not in design. According to the U.S. Centennial of Flight Commission's Web site (www.centennialofflight.gov/essay/general_aviation/bonanza/GA10.htm), *in 1982, "Beech discontinued production of the V-tail Bonanza to concentrate solely on the straight-tail Bonanza 36. Concerns over the safety of the V-tail design (and the resultant liability) undoubtedly played a major role in that decision. Independent studies found that the V-tail Bonanza had a fatal in-flight failure rate 24 times higher than the straight-tail version; a possible cause is the greater stress placed on the V-tail aircraft's tail and fuselage during pitch and yaw maneuvers than on the straight-tail version."*

Give *Glacier Girl* a Break

In the early 1990s, I got a chance to see parts of the P-38 that had been recently salvaged from under the Greenland ice cap ("And the Winner Is...," Aug. 2007). Looking at the patriotic words of encouragement that assembly plant workers had painted on the port boom, and at the bullet holes where the pilot had shot up the radio to keep its technology secret, I couldn't have been more in awe if I were standing in the middle of King Tut's tomb.

I fear what could happen to *Glacier Girl* if she continues to be flown around as if she were yet another P-51. The idea of a transatlantic flight to complete her original mission, while romantic, is also, to my thinking, irresponsible.

Robert Wade
Douglasville, Georgia

Correction

Aug. 2007 "Coffee, Tea, or a Knuckle Sandwich?" (Then & Now): Bill McGlashen is a flight attendant with America West, not Southwest Airlines.

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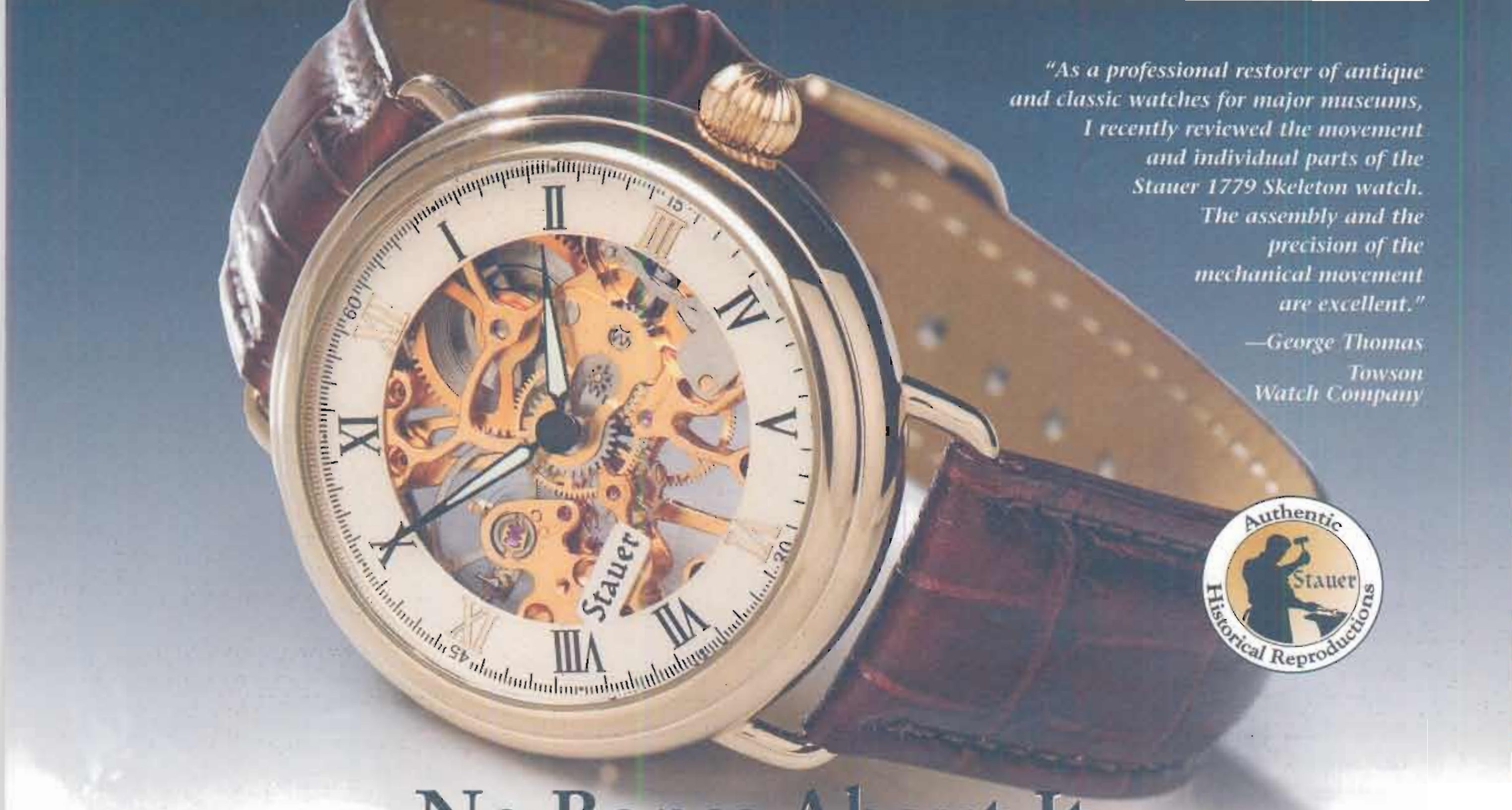

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Towson Watch Company

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Beauty is only skin deep but the Engineering Goes Right to the Bone. Intelligent Collectors of vintage mechanical watches have grown bored with mass produced quartz movements. Like fine antique car collectors, they look for authenticity, but they also want practicality from their tiny machines. Inspired by a rare museum piece dating to 1779, we engineered this classic with $31,000,000 worth of precise Swiss built machinery to create the intricate gears and levers. So the historians are thrilled with the authenticity and the demanding engineers are quite impressed with the technical performance.

See All the Way Through. The crystal on the front and the see through exhibition back allow you to observe the gold-fused mainspring, escapement, balance wheel and many of the 17 rubies work in harmony. The balance wheel oscillates at 21,600 times per hour for superb accuracy. The crocodile embossed leather strap adjusts from 6 1/2" to 9" so it will fit practically any wrist. So give it a little wind and the gears roar to life.

The Time Machine. We took the timepiece to George Thomas, a noted historian and watch restorer for major museums, and he dissected the 110 parts of the vintage movement. He gave the "1779" top reviews. "It is possible to build it better than the original, and your new skeleton requires so little maintenance." When we shared the price with him, George was stunned. He said that no other luxury skeleton can be had for under $1000. But we pour our money into the watch construction, not into sponsoring yacht races and polo matches. We have been able to keep the price on this collector's limited edition to only three payments of $33.00. So you can wear a piece of watch making history and still keep most of your money in your pocket, not on your wrist. This incredible watch has an attractive price and comes with an exclusive 30-day in-home trial. If you're not completely satisfied with the performance and exquisite detail of this fine timepiece, simply return it for a full refund of your purchase price. The Stauer Skeleton watch is a limited edition, so please act quickly. Historical value rarely repeats itself.

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Soundings

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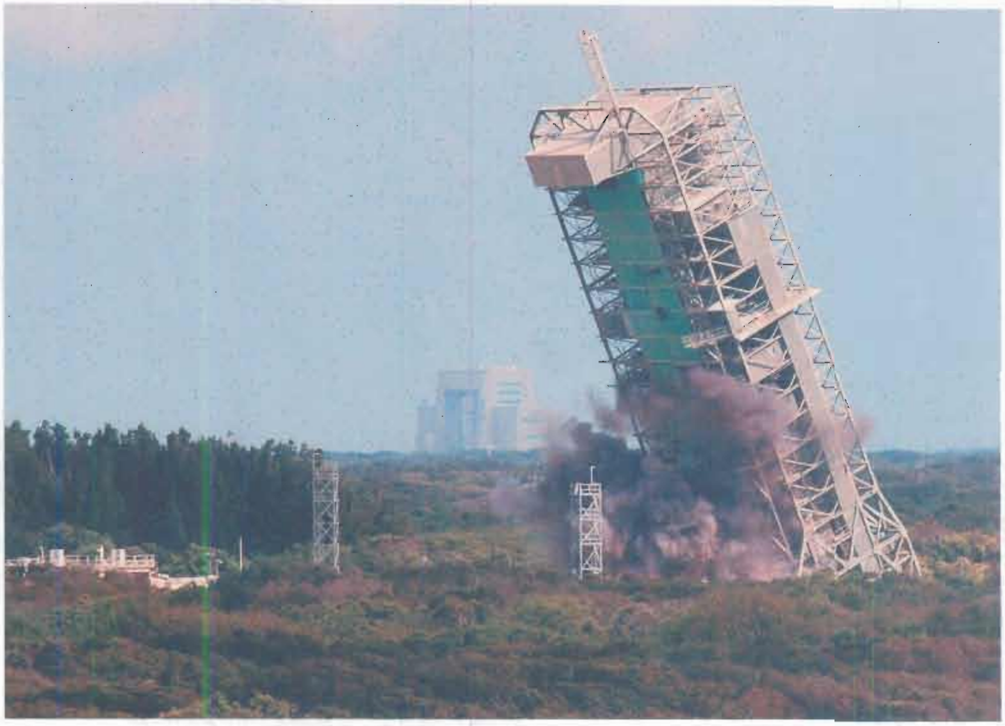
Recycling Complex 36



Some 120 pounds of dynamite took down a mobile service tower at Cape Canaveral Air Force Station's Launch Complex 36.

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>>> **THE LAUNCH PADS** at Florida's Cape Canaveral Air Force Station get plenty of smoke and fire, but usually it's the rockets they hold, not the towers themselves, that blast off. Last summer, the historic Complex 36 was demolished, a victim of rust and a changing era.

Originally built to send unmanned Atlas rockets into orbit, the two launch towers at Complex 36 were used in 145 missions, including dispatching probes to Mercury, Venus, Mars, Jupiter, and Saturn, as well as Apollo-precursor robotic spacecraft to the moon. The 209-foot-tall towers were later transferred from NASA to the Air Force for military missions and to lease out for commercial launches. The Air Force, however, wanted a new version of the Atlas, one that could be quickly prepped for launch and was more suited to a variety of missions. The updated Atlas required a new type of launch pad, so, after a final flight in February 2005, Complex 36 was abandoned.

For a time, it appeared the startup commercial launch firm Space Exploration Technologies, or SpaceX, might be interested in taking over Complex 36 for the Florida operations of its Falcon rockets, but the California-based company ultimately decided on nearby Complex 40 instead.

Concerned the rusting towers would become a safety hazard, the Air Force undertook a massive recycling project. On a sunny Saturday morning last June, workers laced the base of the towers with dynamite and toppled the launch complex in seconds. The rubble, which will take several months to clear, included 3,600 tons of steel.

"It was kind of a sad feeling," says James Womack, a former launch director who spent most of his career at the launch complex. "I realize it had to be done because the launch towers were in kind of bad shape."

No one has yet made a pitch to take over the land for a new project, but, says Air Force spokesman Ken Warren, there is some interest brewing in the commercial world.

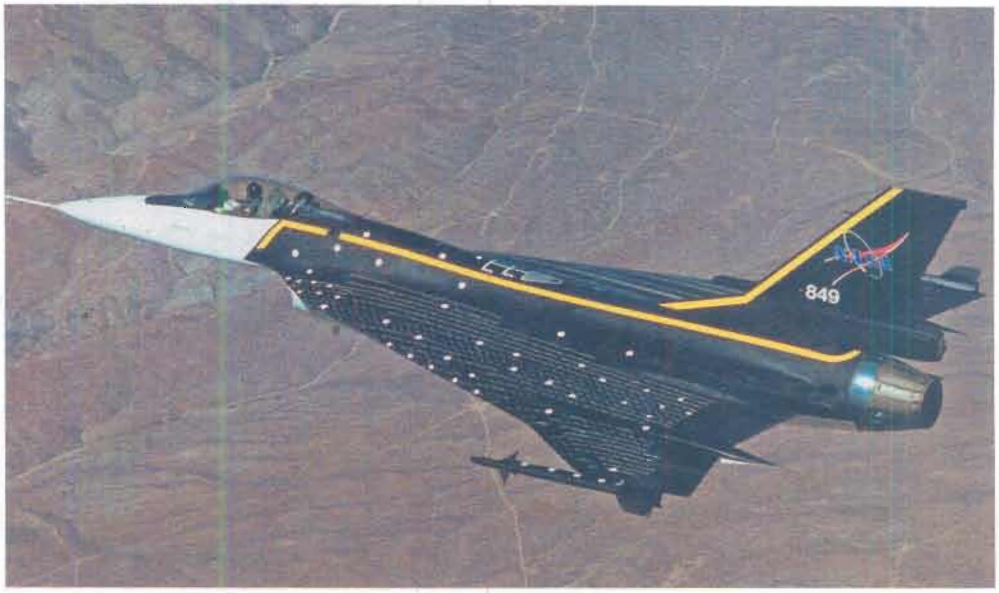
■■■ IRENE KLOTZ

UPDATE

Northrop Grumman Buys *SpaceShipOne* Maker

NORTHROP GRUMMAN, which had held a 40 percent stake in Scaled Composites, revealed last July that it would increase its holdings in Burt Rutan's Mojave, California company to 100 percent (see "Confessions of a Spaceship Pilot," June/July 2005). A Northrop Grumman spokesman said that Scaled "will continue in its current operating model as a separate entity within Northrop Grumman" and that Rutan and Scaled management will remain in place. The partnership between Scaled and the Virgin Group, which seeks to begin suborbital space tourist flights in 2009, remains unchanged. A July 26 test stand explosion at Scaled that killed three has not resulted in any alterations to the overall plans.

The F-16's Kid Brother



The "XL" in F-16XL doesn't stand for Xtra Large – but it could stand for Xtra Lovely, thanks to the cranked-arrow wing and the elegant paint scheme. Two test beds were built; one may fly again.

NASA DRYDEN

>>> **HOW DO YOU RING** in a milestone anniversary when the honoree, although distinguished by design, never really measured up to professional expectations?

Last July 3, the F-16XL Fighting Falcon turned 25, and a veritable Who's Who of the aviation world turned up in the Brazos Room at the Lockheed Martin Recreation Association in Fort Worth, Texas. Among the more than 160 partygoers were Clarence Hart, one of the head engineers on the project, aviation historian Jay Miller, and Randy Kent, the program director of General Dynamics from 1985 to 1991 and more to the point, the program director of the F-16XL Fighting Falcon.

The thing is, though, this Fighting Falcon never fought. The XL design was a technology demonstrator that its creators hoped would go into production, as the standard-issue F-16 did in 1978.

"As a former program director, it was my duty to bring all my bad news," Kent told a rapt audience. "The essence of it was that we were cruising along, getting good marks for schedule and budget, and then suddenly the whole program was basically canceled in 1985."

Two prototypes of the single-seat F-16XL were designed and built by the former General Dynamics in the early 1980s to show off sophisticated avionics and to demonstrate supersonic cruise. NASA used the aircraft to study hypersonic booms and laminar flow for the High Speed Research program, which was canceled in 1999. The XL was the first fighter mapped out digitally rather than with drafting and drawing boards. It boasted a larger payload capacity and longer range than its F-16 sibling. The "cranked arrow"—acute anhedral inboard and dihedral outboard—delta-wing configuration, developed with NASA, provided better low-speed lift and was optimal for air-to-ground missions.

The Air Force considered the XL for its Dual Role Fighter mission, which was ultimately won by the F-15E Strike Eagle. That's why the XL never made it into production.

The Air Force considered the XL for its Dual Role Fighter mission, which was ultimately won by the F-15E Strike Eagle. That's why the XL never made it into production. The program, however, was considered a success in engineering circles. "After the XL was canceled, most of the people went into the advanced tactical fighter program," Kent said. "And after the F-22 got off the ground, a lot of people went to the F-35 program. So in a sense, the experience they had with the XL made a lot of difference down the line. From a technical standpoint, the XL was a brilliant idea."

NASA's Dryden Flight Research Center in California recently announced plans to return one of the aircraft to flight, perhaps as early as this winter, to aid in sonic boom reduction studies.

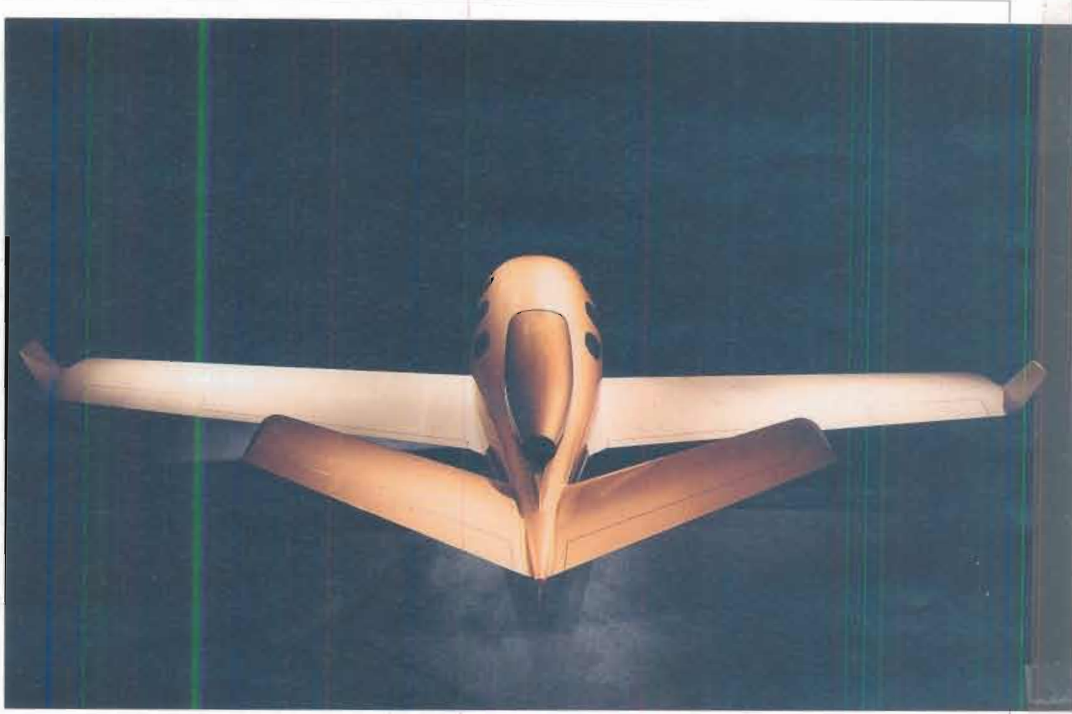
■■■ ADAM PITLUK

UPDATE

Roll Out the Barrel

AIRBUS HAS SWITCHED the composition of the A350XWB airliner fuselage barrel from composite panels on an aluminum frame to all-composite, following Boeing's lead on the 787 Dreamliner. Industry executives have advised Airbus that it must embrace composites or be left behind. Dreamliner fuselages are constructed by Japanese, U.S., and Italian firms that specialize in composite structures (see "Alenia's Gamble," June/July 2007). The technology will loom large in aircraft that will replace the Boeing 737 and 777.

Selling a Slow Jet



The-Jet mockup, like a B-2 bomber, has a two-piece windshield, plus an over-the-fuselage engine placement and V-tail, making it resemble the Global Hawk.

COURTESY CIRRUS DESIGN (2)

>>> **LAST JUNE,** Cirrus Design unveiled a mockup of its single-engine personal jet. Cirrus, which began as a kitplane company in 1984, today makes the world's best-selling certified single-piston-engine airplane, the SR-22. That Cirrus had been working on a jet was one of the industry's worst-kept secrets, even though the design group of the Duluth, Minnesota company had toiled stealthily on the project since 2000 in an unmarked building. (Employees affectionately called the building Moose Works, a play on Lockheed's Skunk Works.)

Founders Alan and Dale Klapmeier had been thinking about a jet since the late 1980s, when they began talking to jet engine maker Williams International about stuffing one of its FJ44 lightweight turbofans in their VK-30 kitplane.

Over the years, people would invariably ask the Klapmeiers, "What's going on with the jet?" The brothers generally responded with mute smiles until last year, when they formally acknowledged the project and Alan Klapmeier teased, "It's going to be the slowest jet you can buy." So many people asked about "the jet" that the phrase is now the airplane's official name.

Cirrus is leery of saying too much about the airplane, after seeing other light-jet makers choke on pronouncements they could not honor. The "goals" for The-Jet include a top speed of 300 knots (345 mph), a range near 1,000 miles, and a price of around $1 million. The company sees The-Jet market as affluent owner-pilots, including current owners of its piston airplanes. Customer deliveries could begin in four years. Already more than 150 customers have plunked down $100,000 deposits.

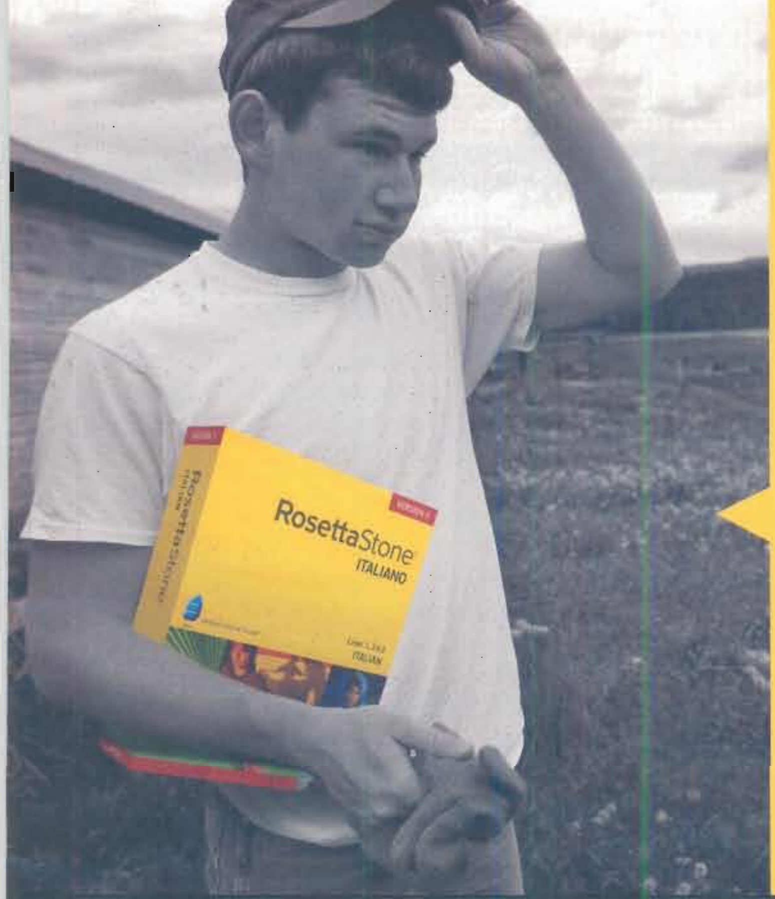
Alan Klapmeier thinks it will cost about $150 million to develop The-Jet. While the company begins development, it also faces the challenges of educating potential customers about the seemingly oxymoronic benefits of low and slow jet travel.

MARK HUBER

That Cirrus had been working on a jet was one of the industry's worst-kept secrets, even though the group had toiled stealthily on the project since 2000 in an unmarked building.

Descendants Rise to the Occasion

>>> **A DESCENDANT OF** the Wright brothers recently met her Brazilian counterpart. Last May at São Paulo Air Base, Amanda Wright Lane, great-grandniece of Wilbur and Orville Wright, met Mario Villares, grandnephew of Alberto Santos-Dumont. The meeting had been arranged by Fernando Arruda Botelho, a Brazilian executive and pilot who



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promotes Brazil's aviation heritage through his private foundation, the Arruda Botelho Institute.

Villares said Santos-Dumont's pioneering work is virtually unknown in the United States and not widely known even in Brazil. Lane said she admires Santos-Dumont's passion for flight. "He saw flying in so many ways," she said.

Santos-Dumont, a Brazilian native, moved to France to study engineering in the late 1800s. He designed a series of powered lighter-than-air ships, then focused on winged flight.

The Wright brothers made their first powered flights at Kitty Hawk, North Carolina, in 1903. But the claims of the two publicity-shy brothers were viewed with skepticism, while Santos-Dumont had made a reputation with lighter-than-air flight and had won a French prize for the first heavier-than-air powered flight in 1906. Europe finally recognized the Wrights after their first European public flights in Le Mans, France, in 1908.

■■■ TIMOTHY R. GAFFNEY

TIMOTHY R. GAFFNEY

Villares, Lane, and Botelho (left to right) show off a model of Lane's great-uncles' creation, the Wright *Flyer*.

>>> Air&Space Interview <<<

David Sington

DIRECTOR, *IN THE SHADOW OF THE MOON*

BRITISH FILMMAKER, WRITER, AND PRODUCER DAVID SINGTON has created science documentaries for "Nova" and the BBC. In his most recent film, *In the Shadow of the Moon*, Apollo astronauts tell their own stories through intimate interviews interwoven with original NASA footage, much of it never seen before.

This seemed to be the documentary that people were talking about at the Sundance Film Festival.

There are, what, seven billion on the planet and nine of us have stood on another planetary body. This is not a film about the Apollo mission; it's about the Apollo astronauts. The first shot is of Jim Lovell jogging on the beach, 1960-something. The film is very humorous and the interviews were hilarious. I was laughing my head off, and I was moved to tears. That is the experience I want the audience to have: *I have spent an evening with 10 remarkable men and I feel I know them a bit now.* If you listen to the downlink of the moonwalk, they are on the highest of all highs. That is what I think audiences respond to, the intense emotionality: *Gosh, they have feelings, they are not robots.*

COURTESY DAVID SINGTON

David Sington says his film is not about the Apollo mission; it's about the Apollo astronauts.

People respond to the human stories, yet they also see astronauts as larger-than-life heroes.

A fundamental mistake that a lot of filmmakers make approaching films about people going into space is to focus on the fear and peril. Because actually, these guys are trained and habituated not to feel fear very strongly. If you have that reaction, then you can't be a test pilot and you certainly cannot be an astronaut. So if you do a film all about going into space and how dangerous it is, the astronauts will never give you that emotion. The net result is you think these guys don't give any emotion at all. But that is dead wrong. They are feeling all of the emotions – joy, exultation, exuberance, all of those things. When I looked at the footage of people watching the Saturn rocket, every single person has this great big grin plastered on their face.

You have a long sequence in the film of a 1960s Dream Whip commercial, a bit of Americana and context.

We all grew up watching television. And these jingles take you right there: "Gosh, I was seven." You get very strong nostalgia reactions. That is the power of popular culture, and you love it when the man on the moon is sponsored by Kellogg's.

I've never heard anyone say, "Man, I'm glad we beat the Russians to the moon." That may have been the political impetus, but on the day of the moon landing, everyone was thinking big.

Apollo happened very much in the context of the cold war. However, it was another way of fighting the cold war that did not involve dropping bombs. America fought the cold war militarily, but it also fought it culturally, technologically, and spiritually, if you will. Apollo showed America at its sort of generous, courageous, and adventurous best.

Clockwise starting top left: Caño Negro Wildlife Refuge; Tortuguero Park Canal Cruise; White Faced Monkey; Keel Billed Toucan; Manuel Antonio Park; Rainforest Hike

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In the Museum

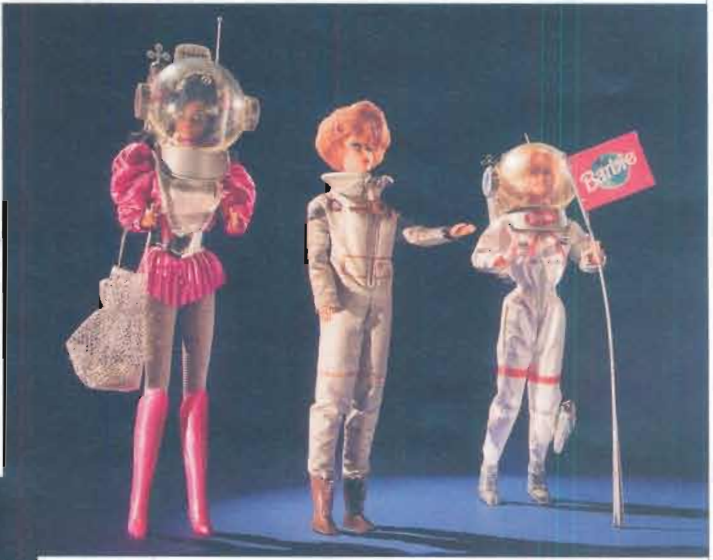
STOPS ON A TOUR THROUGH AMERICA'S HANGAR

Guns & Dolls

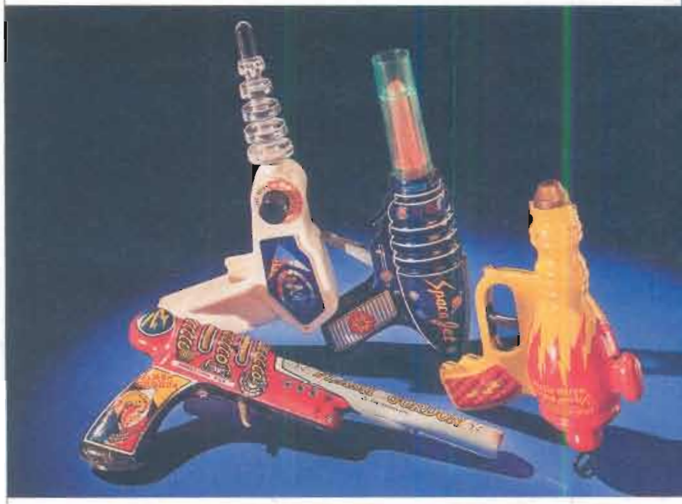
WHO WOULD HAVE THOUGHT that a mechanized toy robot inspired by the 1956 movie *Forbidden Planet* would now be worth some $4,500? That's the estimate toy appraiser Karen O'Brien of Iola, Wisconsin, places on an authentic Robby the Robot. The value of space toys, however, goes beyond their monetary worth. As tie-ins to movies and TV shows, they have cultural and historic significance. "Early space and sci-fi adventures often echoed Westerns; they were stories about what America is or should be," says Margaret Weitekamp, space history curator at the National Air and Space Museum.

For the new display case "Space Science Fiction Toys," which opened last month at the Museum's Steven F. Udvar-Hazy Center in Virginia, Weitekamp culled a selection of ray guns from a collection of more than 2,000 space toys donated by Michael O'Harro, a renowned nightclub entrepreneur. "The guns are essentially space-themed versions of the six-shooter or the rifle," says Weitekamp. "America was built around [the concept] of rugged individualism, and the gun is central to that. The ray gun is a standard part of almost every space adventure."

Weitekamp has arranged the gun display in a way that highlights them as "important objects for our understanding of how we've imagined being in space," she says. "But they're also toys. I didn't want it to look like a gun rack."



In her pink boots and silver leggings, the 1986 Barbie seems more likely to visit a nightclub than the lunar surface; the 1965 and 1994 dolls sport more convincing spacesuits.



Fanciful, zany, and a standard part of many sci-fi adventures, ray (and atomic) guns are the spaceman's equivalent of a cowboy's six-shooter.

ERIC LONG (2)

Before the era of plastic toys, water guns were made of metal, like the 1936 X-Z 44 Liquid Helium Water Pistol, sold as a tie-in to the comic strip Buck Rogers. The water sac inside the gun is made of leather. The Flash Gordon gun, made in 1952, is actually a re-issue of a gun made in the 1930s, when Flash Gordon debuted as a comic strip. After the story regained popularity in the form of a 1950s television series, the manufacturer "pulled out the same presses and started making the gun again with new lithography," says Weitekamp.

A 1970s laser gun in the collection represents a change in materials and scientific knowledge. "Exactly how one blasted one's enemies reflected the latest technology," says Weitekamp. The dial on the side of the gun allowed you to "adjust the level of laser death you'd unleash upon your opponent."

In the 1960s, if you were a kid who didn't play with guns, chances are you played with dolls. The Mattel Barbies in the exhibition were introduced into the Museum's collection in 1995. A 1965 doll wears a Mercury spacesuit, while the Barbie from 1986 is dressed in an outlandish outfit that includes thigh-high hot-pink boots and silver leggings. "What's striking is that [the 1986

Barbie] came out when there were actually women in the space program," says Weitekamp. The Barbie from 1994 commemorates the 25th anniversary of Apollo 11. Her outfit is based on the real astronauts' spacesuits.

Another group of space toys in the exhibition comes from collector Eric Gewirz and was donated by his family's foundation, the Carl and Nancy Gewirz Fund, Inc. The metal toys were made in Japan from the 1950s through the 1970s. "These toys were literally part of a cottage industry," says Weitekamp. "Big companies were creating the lithographed metal and organizing distribution of the toys, but the actual manufacturing was often done in individual family homes."

Weitekamp says that as a result of Allied targeting of Japanese factories during World War II, the workers moved many machines into their homes for safekeeping. "After the war, many of those people took the opportunity to buy the presses or lathes from the manufacturers and set up family businesses," Weitekamp says. "It was essentially piecework." The setup enabled families to remain together while making money; moms and children worked on the toys.

By the late 1950s and '60s, Japanese toys had become popular worldwide. "They evolved from cheap little metal playthings to sophisticated toys with moving parts and batteries," Weitekamp says. Examples include a red Rosko robot with battery-powered arms and legs, and wheeled feet, and a silver robot, an unlicensed version of Robby the Robot from *Forbidden Planet*, made in Tokyo by Nomura Toy. The collection even includes a googly-eyed robot dog that can move forward and flap its jaw.

During the same period, says Weitekamp, space became such a popular theme that toy makers "were slapping 'space' on anything at all: space dog, space elephant, space whale, space tank. Space sold toys."

With this year's 50th anniversary of the Sputnik launch, talk of human exploration of Mars, and plans for commercial space travel, there may be a new generation of buyers in the market.

■■■ BETTINA HAYMANN CHAVANNE

Visitor Information

Curator's Choice National Air and Space Museum curators give weekly 15-minute talks about artifacts or subjects of interest. At the Steven F. Udvar-Hazy Center in northern Virginia, meet at the nose of the SR-71 Blackbird aircraft at 12:30 p.m. Oct. 4, (Almost) 30 Years of Star Wars Action Figures. Oct. 18, Charles A. Lindbergh and the American Consumer.

What's Up Receive regular updates on Museum events, read about artifacts, get detailed (and behind-the-scenes) exhibition information, and receive calendar listings by subscribing to the National Air and Space Museum's free monthly e-newsletter, *What's Up*. Sign up at *www.nasm.si.edu.*

Star Party Join Museum staff astronomer Sean O'Brien on Saturday, October 13 (6:30 p.m. to 10 p.m.), and November 10 (6 p.m. to 10 p.m.), in observing celestial objects in dark skies unpolluted by city lights. Sky Meadows State Park, Virginia. Parking fee: $4 per car. Park phone: (540) 592-3556.

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ARTIFACTS

Globe Trotters

"PASSENGER AIR TRAVEL IS SO ingrained in our culture, it's natural that we take its development and success for granted," notes National Air and Space Museum director J.R. Dailey of the origin of the new "America by Air" exhibition, which guides visitors through the history of air transportation. One of the commercial aviation visionaries featured is Pan American Airways founder and president Juan Trippe, who used this 19th century globe to plot international routes, putting the far corners of the world within reach.

Juan Trippe's globe made an appearance in the Howard Hughes biopic *The Aviator* before arriving at the Museum.

ERIC LONG

Sucked Up

FEBRUARY 14, 2007, was the first day of a paragliding competition in Manilla, New South Wales, Australia, a run-up to the Paragliding World Championships that would be held in Sydney. I'll remember the day for another reason.

That morning, competition organizers had told us there was a chance of thunderstorms. Generally, if a front is passing through, organizers will cancel the day's competition. But the forecast noted only isolated thunderstorms, so they just warned us to be careful. If you stay clear of clouds, there's no problem.

About 100 pilots were competing in a series of tasks. In one event, we would race from one point to another, trying for the best time. In another, we would be judged by precision on a course from point A to B to C. Today was a distance race; we were to fly as far as possible.

It was sunny, with fluffy cumulus clouds and wind out of the south—perfect flying conditions. I took off around noon and turned to the north, as did everybody else, to take advantage of a tailwind.

I flew for two hours at an altitude of about 6,800 feet, maybe 300 feet below the cloud bases. Ahead were two big cumuli. I flew between them, as did most of the 60 or so pilots around me. As we left them behind us, the clouds merged and grew into a thunderstorm. I believe most of us thought we were far enough away from it, about 10 miles. That may not seem like a healthy distance, but as a competition pilot, I was confident that if I got into trouble, I could spiral down very fast and land by initiating a tight turn with the left or right brake, which would increase the bank angle of the wing and enable me to descend vertically, with no horizontal movement. It's a high-G maneuver that can make you dizzy, but in a competition, you tend to push the limits just a little.

TONY RICHTER

The author, "Birdy" Wisnierska, Germany's female paragliding champion, has been flying for 10 years.

To the north were beautiful sunny skies—no danger. Just ahead and slightly above me was an innocent-looking cumulus, maybe 1,500 feet tall. I knew I couldn't fly under it because if I caught any lift, I'd be sucked into the cloud, where turbulence could collapse my wing or strong updrafts could pull me to unsafe altitudes. As I tried to edge around it, I suddenly got very strong lift. Three times I tried to spiral down but I couldn't descend faster than the lift was carrying me up.

I realized that I was not going to get down. I was deep into the cloud and I couldn't even tell what direction I was flying in. My Global Positioning System heading indicator was spinning wildly. I tried to just fly straight, hoping I could get out of the powerful updraft, but it was not possible. The paraglider was turning on its own—I had no control, and the lift kept getting stronger.

I remember thinking that since the cloud hadn't looked so big, I would soon pop out of the top. Even if it was 10,000 feet tall, I should be okay. But when my altitude read 13,000 feet, I was still in cloud. It got dark; there was rain and then hail and a lot of turbulence. The wing kept collapsing—I had to work hard to keep it filled with air.

I used my radio to call my team leader and crew. All I could get out was "I'm in cloud and it's raining and

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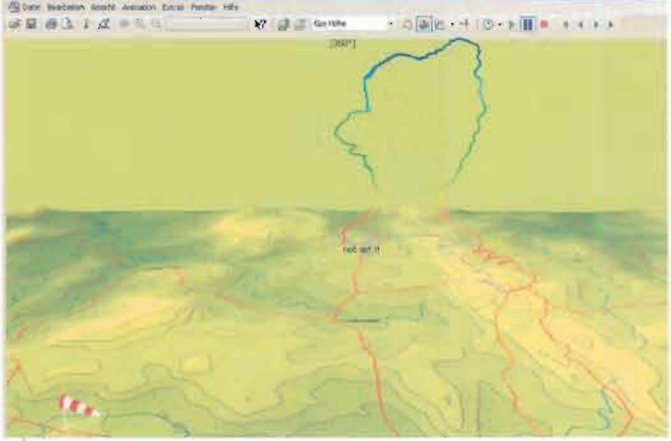

Paragliders, like sailplanes and hang gliders, are at the mercy (or lack thereof) of thermals and winds. Wisnierska's data track (left) shows about three miles of horizontal travel – and six miles of vertical. Had she been in Nepal, she could have looked down on Mount Everest.

COURTESY EWA WISNIERSKA

hailing and I can't do anything."

I considered using my reserve chute. It's a simple round parachute designed to open by static line. But I couldn't free-fall through the cloud and then open it because the rapid descent would destroy it. And after the reserve opened, I'd have no control.

At around 16,000 feet, it got pitch-black and terribly cold. I could hear thunder all around me, but I never saw lightning; my sunglasses were covered with ice. I couldn't even see my wing. I said to myself, *Not here. Not like this. Please let me come down, anywhere.*

Then, another jolt of very strong lift sent me hurtling upward. G-forces pushed my head back and pressed my body into the harness. I felt my eyes roll back. I believe that not long after, I passed out. Judging from the time that passed and my rate of climb, I must have been at about 21,000 feet.

My onboard tracking equipment showed that my glider continued to climb in a slow right turn, so when I passed out I must have been leaning to the right. I got to 32,631 feet before the lift ended. The glider flew big circles to the right for some 20 minutes. Then I started to sink a little bit, and after another 20 minutes I hit a big downdraft and descended at 75 mph. I fell 10,000 feet, and then I think the wing must have fully inflated because a jolt woke me up.

How long had I been unconscious? At first I thought it was only a moment, like when you nod off for a second while you're driving and then snap to. I was limp in the harness. I tried to pull on the brakes and realized I didn't have them in my hands. They were hanging, covered in ice. My gloves were frozen. I had to sit up in the harness to grab the brakes. I then realized I must have been out for more than a moment or two.

I was exhausted—largely due to the lack of oxygen at the altitudes I reached. The wing was fully inflated and the paraglider was flying normally. The air was smooth. But I was still in cloud, in the dark. I had to scratch the ice off the face of my GPS to read it: 22,600 feet. A long way to go.

I was trembling violently from the cold. I saw that I had traveled about three miles horizontally since I'd gotten sucked into the cloud, but I had no idea where I was.

I was descending, but after 15 minutes I thought I should hurry it up and spiral down. From 13,000 feet I gently spiraled until I could see the ground. Only at that point did I think I was probably going to make it.

I couldn't see any roads. If I just landed, I might have to walk for days to get help. I leveled off and kept flying. Finally I saw a small farm. A tail wind helped speed me toward it.

My radio was frozen, so I had no way to contact my team. After I landed, I just curled up on the ground, waiting to warm up. After a minute my cell phone started ringing. I had forgotten that I even had it. It was my crew.

When they got to me, we went straight to the hospital, where physicians diagnosed frostbite on my nose and ears and bruises from the hail. My blood oxygen level was normal.

I learned that fellow pilot He Zhongpin had also been sucked into the killer cloud, but he had not been as fortunate as I'd been. He died of hypoxia or hypothermia or both.

Why did I survive? Perhaps I had gained a slight advantage by spending a month at high altitude in Mexico just before I came to Australia. And when you're unconscious, body functions slow and the need for oxygen decreases. That helped, and sheer luck. I had the number 9946 (meters; 32,631 feet, my maximum altitude) stitched into my paraglider wing as a tribute to that luck.

■■■ **EWA WISNIERSKA**

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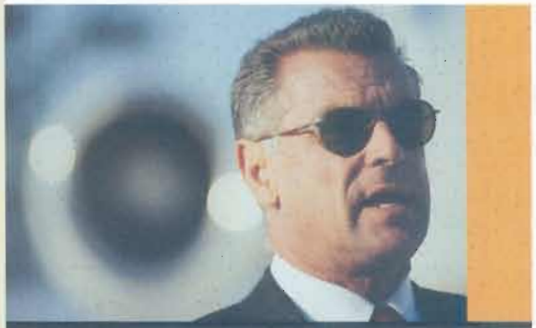


Brian Grote is a flight instructor with 20 years aviation experience. He also writes monthly columns on subjects pertaining to aviation.

FLYBY

ARTICLE WRITTEN BY: BRIAN GROTE

Dear Brian,

I've been flying for over 20 years. My usual run is a Denver departure at 9pm, fly to Billings, on to Cheyenne and then back to Denver by 5am. I fly a King Air 350. I love my career and I pride myself on doing the best job I possibly can.

Last time out, however, I was making lots of little mistakes. I was cleared for the ILS Runway 35R into Denver, but I couldn't pick up ATIS. That's when I looked at my radios and noticed I had dialed in the wrong frequency. I glanced again and dialed in the right frequency. I continued through my checklist and set my Radar Altimeter to 5500 feet. I was ready to make my descent and start my approach. After the outer marker I glanced at my DH again and noticed that I had set my Radar Altimeter, 67 feet low. Luckily, I landed safely, bouncing the wheels just a little.

After a couple more days in the sky I could tell my eyesight was beginning to deteriorate. I knew I wouldn't be able to renew my first class medical if I didn't do anything about it. I was really worried and started asking my peers if there was anything I could do. A co-worker gave me a bottle of Claroxan™ and told me it would help me maintain my depth perception. I was skeptical at first, but tried it anyway. As it turns out, the stuff works great. The problem is, I ran out and don't know where to find more. Have you heard of this Claroxan™ stuff? Is it available in the States?

Jason, 46 – Seattle, WA

Jason,

Not only do I know of Claroxan™, it just so happens I take it everyday. Being a pilot myself, I know that perfect visual acuity is an asset none of us can afford to lose. That's why every pilot should be protecting their eyesight before it's too late.

Claroxan™ contains ingredients proven beneficial for the eyes. Among these ingredients are lutein and zeaxanthin – powerful antioxidants that have been clinically proven to protect the retina and macula and, in some cases, reverse the damaging effects of macular degeneration. These antioxidants block damaging UV rays and halt damaging free radical oxidation in the back of the eyes. They have also been clinically proven to decrease the risk of cataracts.

Claroxan™ also contains bilberry, an anti-oxidant known to improve night vision. Bilberry's night vision enhancing effects were first noticed in England in the early 1940's. The RAF ordered English fighter pilots to eat bilberry jam on toast figuring it would give them an advantage during night raid missions against the German Luftwaffe fighters.

Claroxan's unique proprietary formulation is completely safe, all-natural and extremely affordable. As far as ordering it, you can call them toll-free at 866.775.3937, or go to www.claroxan.com. I usually get mine within a week after ordering.

Hope this helps!
Brian

THE himalayan CATARACT project

The Himalayan Cataract Project strives to eradicate preventable and curable blindness in the Himalaya through high-quality ophthalmic care, education, and establishment of a sustainable eye care infrastructure.

Based in Asia, at Kathmandu in Nepal, the Project is empowering local physicians to alleviate the suffering caused by blindness through unique programs including skills-transfer education, cost-recovery, research, and the creation of a world-class network of eye care facilities.

In 2004 and 2005, 3% of PacificHealth profits were donated to HCP for development and construction of eye facilities in the Himalaya.

Visit CureBlindness.org to learn more about HCP.

CLAROXAN™ | LEADER IN VISION IMPROVEMENT

Sunlight, aging, and diet each cause damage to the retina and macula, which can lead to a decline in vision that glasses or contacts can't help. If you've experienced an increase in blurriness or difficulty seeing details at any range, then you know how valuable sharp vision can be. What you might not know is that in the past three years, a flood of new scientific research has been done on natural vision enhancement. This medical research suggests that ingredients in Claroxan™ may help maintain and even improve your vision, while at the same time giving you added protection against many ocular diseases

Claroxan™ may improve macular pigment density, which research shows has amazing effects on vision. By improving macular pigment density, ingredients in Claroxan™ may improve normal visual acuity, contrast sensitivity, and even glare reduction. Participants in one clinical study reported that ingredients in Claroxan™ improved their long range vision outdoors – in some cases, they were able to distinguish far away ridges up to 27 miles further than normal! Even if you have perfect vision now, Claroxan™ may help give you an edge by improving your visual reflexes and may allow you to pick up on moving objects faster than ever before.

People who count on their vision – people like pilots, hunters, military, and even pro athletes – trust Claroxan™ as the best source available for vision enhancement and protection. Claroxan™ is safe, effective, and extremely affordable. However, people with serious health concerns should consult a doctor before use.

Flights & Fancy

WHIMSY, NOSTALGIA, AND JUST PLAIN MISCHIEF

Unhappy Campers

WHEN I WAS 22 OR SO, I joined an Army flying club, which enabled me to learn to fly at far lower prices than were available outside of Fort Campbell, Kentucky, where I was stationed as a paratrooper.

The airplane I learned to fly in was an Aeronca Champion—student pilots called it an Airknocker—which was little more than a motorized box kite. A control stick jutted up from the center of the cockpit floor. The throttle was on the left side of the instrument panel, and to start the engine our instructor grabbed the wooden propeller, hiked his leg up like a pitcher preparing for a fast ball, and swung the prop.

QUAK-QUAK-QUAK-QUAK! POW!

The engine caught—and I was airborne. Over the next 20 hours I made many mistakes, but killed no one. My instructor said, "You're ready to solo."

It was one thing to fly with with an instructor, and quite another to go it alone. However, aside from dancing all over the runway, I did okay, and eventually I was ready for a long-range solo flight. It was summer in the South, and I would fly a triangle of 300 miles using visual flight rules because instruments weren't required in 1955. (This is all from memory, so I may get mail from real fliers telling me the throttle is under the seat or someplace.)

Alas, somewhere along the route of rolling hills, I missed a point of reckoning—a highway, railroad track, or river—and soon I was lost, flying above a thick carpet of trees broken by occasional glades.

Eventually I saw a long, flat area, like a playing field of some kind. I whizzed over at 600 feet and saw a lot of people scurrying around. Trees surrounded the pasture on all sides, and some of the people were looking up at the airplane. There must have been three dozen of them, all in clothes as pale as Colonel Sanders' suit.

Now this was a mystery, so I hit right rudder and swung back around, lower this time. The tactic seemed to please the people in the pasture. Several waved their arms vigorously as they jumped up and down, and I waggled my wings cheerfully in return.

Others, however, skedaddled for the woods. My guess was that they were backwoods folks (Kentucky had plenty of them half a century ago) who had never seen an airplane, and who might have been playing a game which I'd interrupted.

In any case, the more I swooshed over them, hoping they'd understand I needed directions, the happier they were, clearly indicated by their gesturing and jumping up and down. Several were fairly dancing with excitement, stopping between sprints to make referee-type signals across their midriffs.

What was this? Some of them were picking up sticks and stones and tossing them upward. To celebrate my flyovers? Such folks merited a closer pass—plus it would give me a better look at the meadow in case a landing proved necessary.

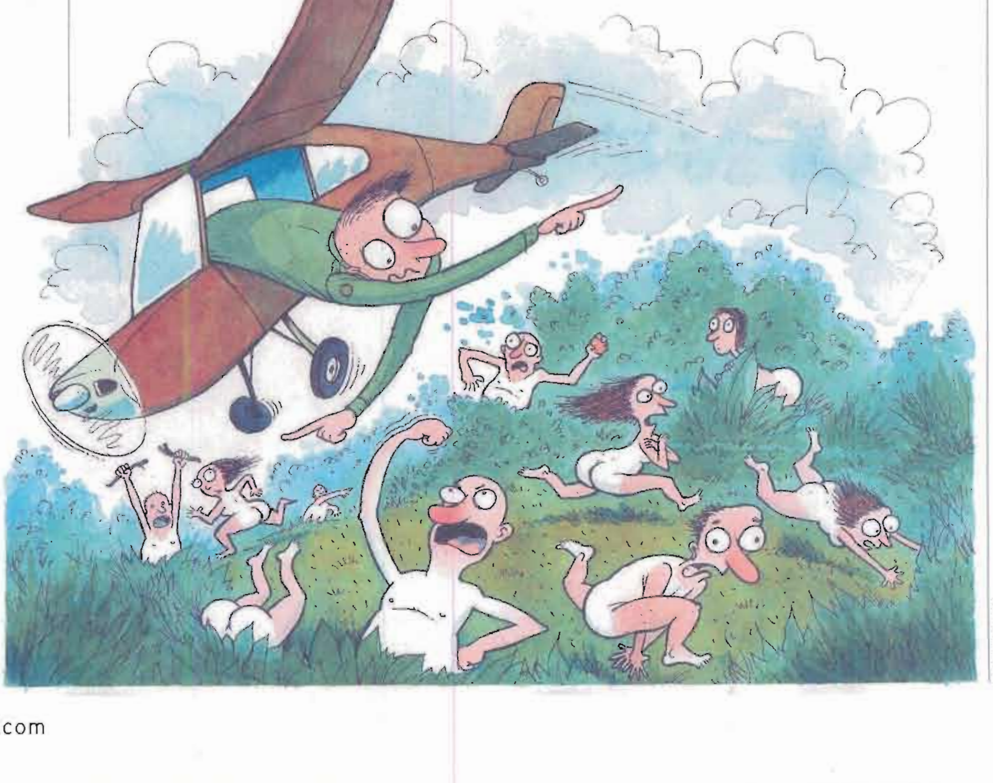
So I spiraled down to 100 feet—and all of a sudden I realized why all those fleet-footed people wore white suits. They were actually wearing no suits at all. I was flying over a nudist camp.

Hoping no one had seen my aircraft number, I throttled up and got out of there. Fortunately, after a few miles I stumbled across a visual flight reference and made it back to base, where I related the bare essentials of my adventure.

"I've been trying to locate that place for months," my instructor said enviously. "Think you could find it again?"

I said I doubted I could get lost twice in the same place, and besides, those folks deserved their privacy.

WILLIAM CHILDRESS



DAVID CLARK

The New York Mint

Numismatic Review

Discovered in a Smithsonian Institution Vault…

The First Coin Design To Show America's "Trust In God"

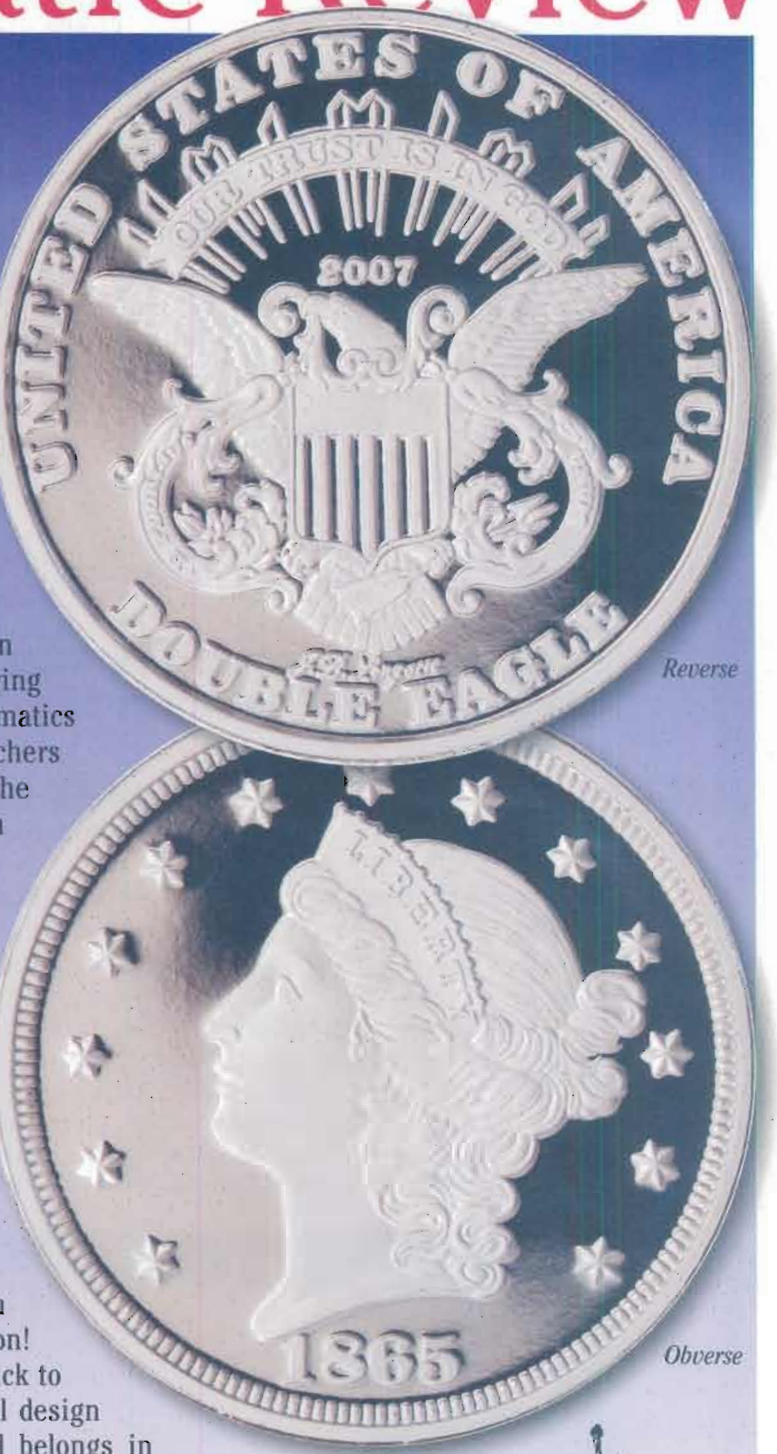
The recent U.S. Mint release of the new $1 Presidential Coins, some without the motto "In God We Trust," has numismatists digging into the history of the motto. The results revealed not only the first design attempting to use the motto, but led to the exclusive striking of this "lost" design for the VERY FIRST TIME!

Unseen for over 140 years!

In 1864, America's first attempt to add a religious motto to its coins was rejected. Filed away in the pages of U.S. Mint chief engraver James B. Longacre's sketchpads, the design remained unseen for over 140 years—until now! While studying Longacre's notes stored in the National Numismatics Collection at the Smithsonian Institution, researchers found that the famed designer's first attempt at the motto was actually for a $20 Gold Double Eagle with the words "Our Trust Is In God." The design was shelved as Congress debated over the inclusion of the motto on U.S. coins. Instead of appearing on a $20 Gold Double Eagle, the first coin to utilize the motto was Longacre's Two-Cent piece with the motto shortened to "In God We Trust."

Why the shortened motto?

Was the motto shortened to accommodate the smaller denomination? We'll never know, but now you can own a pure silver Proof of Longacre's first endeavor to convert U.S. coinage with this magnificent proposed-motto design—struck for the very first time from his actual sketches discovered in the numismatic vault at the Smithsonian Institution! Containing one ounce of .999 pure silver and struck to an ultra-cameo Gem Proof quality, this wonderful design commemorates a piece of American history and belongs in everyone's collection. Now you can secure the world's first and only "Our Trust Is In God" Double Eagle Proof for **only $99** (plus S&H). CALL TODAY!



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Air War IRAQ

FROM AL ASAD AIR BASE, PORTRAITS OF U.S. AIRCRAFT AND CREWS IN THE FOURTH YEAR OF FIGHTING.

■ ■ ■

PHOTOGRAPHS BY ED DARACK

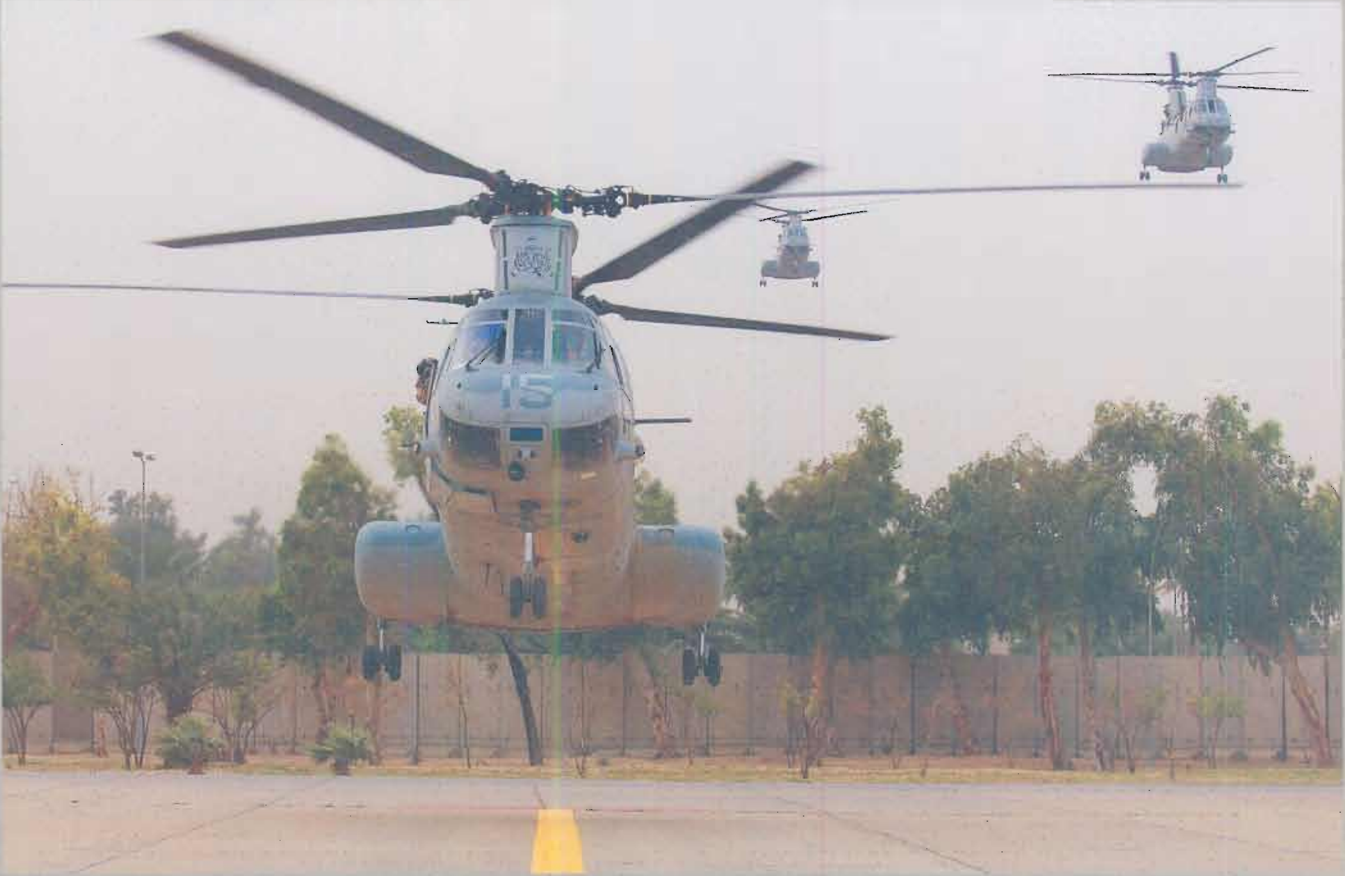
LAST SPRING FREELANCE JOURNALIST ED DARACK embedded with the Second Marine Air Wing, based in Al Asad Air Base, which sprawls across 19 square miles of Anbar province, in the northern Iraqi desert. Roughly 17,000 U.S. military personnel and support staff work at the base and are responsible for dominating airspace the size of South Carolina. Daily flights have taxed the Marine aircraft and crews, with some aircraft flying at five times the rate of other services' aircraft in theater, according to AV-8B Harrier pilot Captain Ryan Hough. "There are *always* aircraft flying or on standby to handle the logistical, combat, and intelligence needs of the Marines on the ground," he says. Aviators told Darack that the missions these days were more likely to be reconnaissance and shows of force. "Our forces have made a tremendous amount of progress with the Iraqi people, so releasing ordnance is a last resort," says Harrier pilot Major Kain Anderson. Darack had access to virtually all the kinds of aircraft currently flown by the U.S. Marine Corps—the V-22 Osprey will be joining the Corps in the fall—and an attached Army medical helicopter unit, at work from their improvised home at Al Asad.

—The editors

<<< FROM A UH-1N HUEY helicopter, Corporal Andy Vistrand, a "Gunrunner" in Light Attack Helicopter Squadron 269, scans the countryside of Anbar province from behind a .50-caliber machine gun.

>>>AN AH-1W SUPERCOBRA flown by the Gunrunners, who hail from an air base at New River, North Carolina, cruises the shores of the Euphrates River south of Haditha.

MARINES



PRIVATE FIRST CLASS Kristin Koeneke from Dubuque, Iowa, ensures the canopy is spotless moments before the F/A-18D Hornet rises for a mission over Ramadi.

‹‹‹ TWIN F/A-18Ds belonging to the "Green Knights" – Marine All Weather Fighter Attack Squadron 121 – use reconnaissance sensors and air-to-ground ordnance to support ground troops. They are shown here on approach to refueling.

THE CH-46E Sea Knight helicopter looks like the nickname bestowed by Marine aviators from Medium Helicopter Squadron 262, who call their rides "Phrogs."

››› A TYPICAL day's work for the Army's 45th Medical Company includes perilous missions over Baghdad.

SEA KNIGHTS from Squadron 262 start a night operation at Al Taqaddum Air Base in Anbar province.

<<< **CAPTAIN ANDREW LADNER** of the Marine Heavy Helicopter Squadron 362 – the Hawaii-based "Ugly Angels" – begins a series of pre-flight checks before taking off from Al Asad in one of the squadron's CH-53D Sea Stallions. The Ugly Angels served as the first Marine aircraft unit in Vietnam in 1962 and were the first squadron to receive the CH-53D in 1969. Sea Stallions, more frequently called "Deltas" by their crews, have an apparantly well-earned reputation for leaking hydraulic fluid; while shooting aerial photographs from the rear fuselage of the aircraft, Darack had to protect his cameras from the spray. "I'm told that if it isn't leaking, then there's a problem," Darack notes. "Nothing left to leak out."

FIND OUT MORE
www.airspacemag.com
SEE ADDITIONAL PHOTOS
and read Ed Darack's
accounts of his time with
the Marines at Al Asad.

<<< SERGEANT KIEL SHAFLEY sprints away from the AV-8B Harrier flown by Captain Nicu "Nasty" Nastase (left) after arming its laser-guided Maverick air-to-ground missile at Al Asad. The aircraft and crew are from Marine Attack Squadron 231, "the Ace of Spades," based in Cherry Point, North Carolina.

>>> A C-130J from Transport Squadron 252 stands silhouetted against a bruised sky. Darack found that the transport and refueling aircraft also make an ideal platform for photography. He lashed himself into the rear of these aircraft, shooting other aircraft from a lowered loading ramp. "The C-130J is a Cadillac," the photographer says admiringly.

TRANSPORT SQUADRON 252 is the longest continually active squadron in the Corps. Its legacy continues at Al Asad, where crews work hard to service the squadron's workhorse C-130Js. With one on station, other aircraft such as the AV-8B Harrier and the F/A-18D Hornet can loiter for hours with a few quick mid-air pit stops.

The Soplata Airplane Sanctuary

Of the 20 stray aircraft his father rescued, the author remembers that first bomber best.

by Wally Soplata

DESPITE HIS HUMBLE BEGINNINGS as the penniless son of Czech immigrants, my father, Walter Soplata, amassed an extraordinary collection of warbirds. He grew up fascinated by airplanes during the Great Depression, using whatever money he could scrape up to build balsa model aircraft. When World War II broke out, a stutter disqualified him from military service.

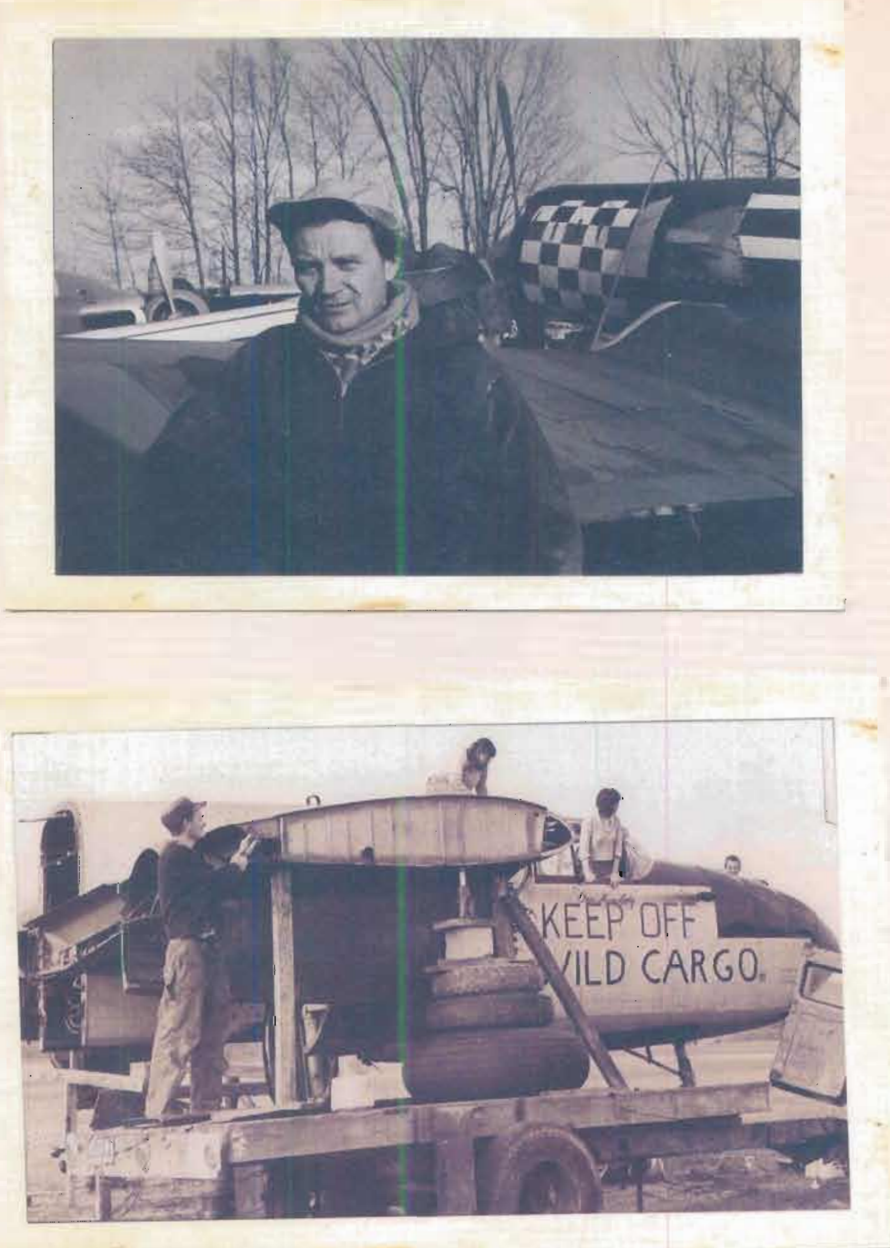
Dad took a job in a Cleveland, Ohio scrapyard, junking thousands of warplane engines that were suddenly declared surplus. In this job, he foresaw the near extinction of the nation's historic aircraft. He felt he had to take action.

On land in Newbury, east of Cleveland, he began his airplane collection in 1947 with a late-1920s American Eagle biplane. A Vultee BT-15 trainer was next, and then in the early 1950s the big iron: a Vought/Goodyear FG-1D Corsair followed by another but much rarer F2G Corsair. The second Corsair, with an experimental brute-power R-4360 engine, had taken first place in the 1947 Cleveland National Air Races. My father went for the rare types: a prototype North American XP-82 Twin Mustang, then an F-82E Twin Mustang with Allison engines, an early Jet Age Chance-Vought F7U Cutlass, and a prototype of the Douglas AD Skyraider series.

In the early 1950s, my parents had four daughters and me, the only child who would pursue a career in aviation. I started in general aviation, then became an Air Force pilot and, later, an airline pilot. I cut my teeth on a twin-engine T-50 Cessna Bobcat—the type Sky King flew in the early years of the eponymous TV series—that I helped my father dismantle and haul by trailer in 1961. But of all the aircraft we dragged home, I recall most clearly a down-and-out B-25: my father's first bomber.

One day in 1964, Dad and I were glued to our black-and-white TV set watching *Thirty Seconds Over Tokyo,* in which Spencer Tracy played Jimmy Doolittle leading 16 B-25 crews from the deck of the USS *Hornet* to bomb Japan. Dad was like a kid excited by a commercial for a toy he just had to have. He wanted a B-25.

When you consider that our home was constructed primarily of lumber from warbird engine crates discarded at a smelter where he'd worked a few years earlier, it was amazing he could think such a thing. That job had provided a meager income, and then he turned to carpentry. The housing market proved sporadic, but Dad had nonetheless managed to start an airplane collection that was already impressive.



PHOTOGRAPHS COURTESY OF THE AUTHOR

Appalled by the U.S. government's destruction of obsolete aircraft, Walter Soplata (top) searched out wrecks, like this F2G Corsair. When his children came of helpful age, they often accompanied him on rescue missions, like the 1964 retrieval of a B-25 (above).

My sisters and I had the perfect clubhouse: a Fairchild C-82 Boxcar fuselage like the one in the original *Flight of the Phoenix* movie.

Dad rarely paid more than a few hundred bucks for an airplane. In the early 1960s, a warbird's price was usually determined by whatever its weight would bring at the scrapyard. Regardless of our dismal financial situation, when Dad pined for a particular treasure, it was likely he would get one. Sure enough, before long a visitor touring Dad's collection had a tip.

"There's a B-25 down at Lunken Airport in Cincinnati that made a gear-up belly landing a few years ago," he said. "I heard they're going to cut it up and scrap it soon."

Scrapped? To Dad, the thought was unbearable. He tracked down the owner who was going to scrap the B-25 and convinced the man to sell it to him for $500.

Now Dad faced the problem of getting the airplane home without destroying it. Since none of the aircraft Dad acquired was flyable, each one had to be hauled on a highway, so the size of each aircraft was a major consideration. Most of the airplanes he hauled were fighters or trainers—relatively small. Even though the B-25 was much smaller than, say, a B-17, it was still a big airplane.

Compounding Dad's hauling concerns, he couldn't afford a truck. All he had were the family's 1957 Chevy Suburban and a two-wheel trailer he had fashioned from the chassis of a delivery van. Though the Suburban was an old rusty clunker, it had proven itself two years earlier when hauling the heavy wings of an F7U Cutlass jet he had won for $200 on a Navy surplus bid. But the Suburban was no match for the long, heavy fuselage of the twin-engine jet. Instead, Dad hauled the fuselage home by stuffing it in a junked schoolbus (but that's another story).

The Soplata kids had a playground that grown men would envy. Above, an impromptu load-bearing test on the wing spar of a rare F-82 Twin Mustang.

On a Saturday in October, Dad, my three older sisters, and I hit the road for Cincinnati before dawn. At 15, Rita was the oldest, with Barb and Margie filling in the four-year gap between Rita and me. The 200-mile drive to Cincinnati was a big adventure. We passed the early-morning hours by playing games and singing "100 Bottles of Beer on the Wall" (the Suburban had no radio).

On the down side, the Suburban, with five aboard, was cramped. Along with snacks, drinks, books, and blankets was all of Dad's equipment: toolboxes, a stepladder, cables, chains, two bomb winches, a few jacks, and assorted wood blocks. In addition, there were spare parts for the Suburban plus several spare tires, since the bald ones Dad drove on were prone to let go. Still, except for having to rest our feet on rusty toolboxes, we were comfy.

When we reached Lunken Airport, Dad got permission to drive onto the ramp and we parked next to the B-25. Despite the story of the belly landing, the bomber, basically intact, was standing on its landing gear.

Dad's new airplane was in civilian markings, with a Federal Aviation Agency (as it was then called) N-number on the rear fuselage. As a military-turned-civil aircraft, it was missing its gun turrets and bomb racks, though we would discover armor-plated pilot seats and a big steel ring where the top gun turret had been installed.

As expected, the belly landing had ripped much of the aluminum from the bottom of the fuselage. From watching war movies with Dad, I had expected the propeller blades to be bent and curled, but only the prop on the left engine showed this kind of damage. On the copilot side of the forward fuselage, "WILD CARGO" was crudely painted in big black letters.

"I just can't believe it," Dad grinned. "It's like they made this plane to be hauled down the highway!" He showed me that all the major sections were bolted together in just the right places to allow damage-free disassembly. The forward fuselage could be unbolted in front of the wing, and the aft fuselage behind the wing. The outboard wings unbolted just beyond the engines, and even the engine nacelles unbolted slightly aft of the wing.

To Dad, the realization was like learning that the airplane would not be sacrificed to the gods. What he most hated about hauling airplanes was that some had to be cut to fit on the highway, and if a major section of the structure was cut, the airplane would be difficult to put back together and restore to flying condition.

Dad was still in mourning over his first Twin Mustang, the prototype XP-82. To haul it home, he destroyed the wing by cutting it with a torch—only later to discover bolts in a different part of the structure that would have made the torch job unnecessary. He was sick about it.

When he got his second Twin Mustang, he had learned his lesson and hauled it without any cutting. For every airplane that followed the XP-82, Dad studied the airframe carefully before deciding to cut anything.

Our quick study of the B-25 concluded, Dad went into General Patton mode and got all of us busy turning wrenches and screwdrivers. Usually I was the only one with him on trips for airplanes, but on this trip I appreciated having my sisters along; they proved to be a big help, especially Barb, who knew wrenches, sockets, and other tools by name, size, and use.

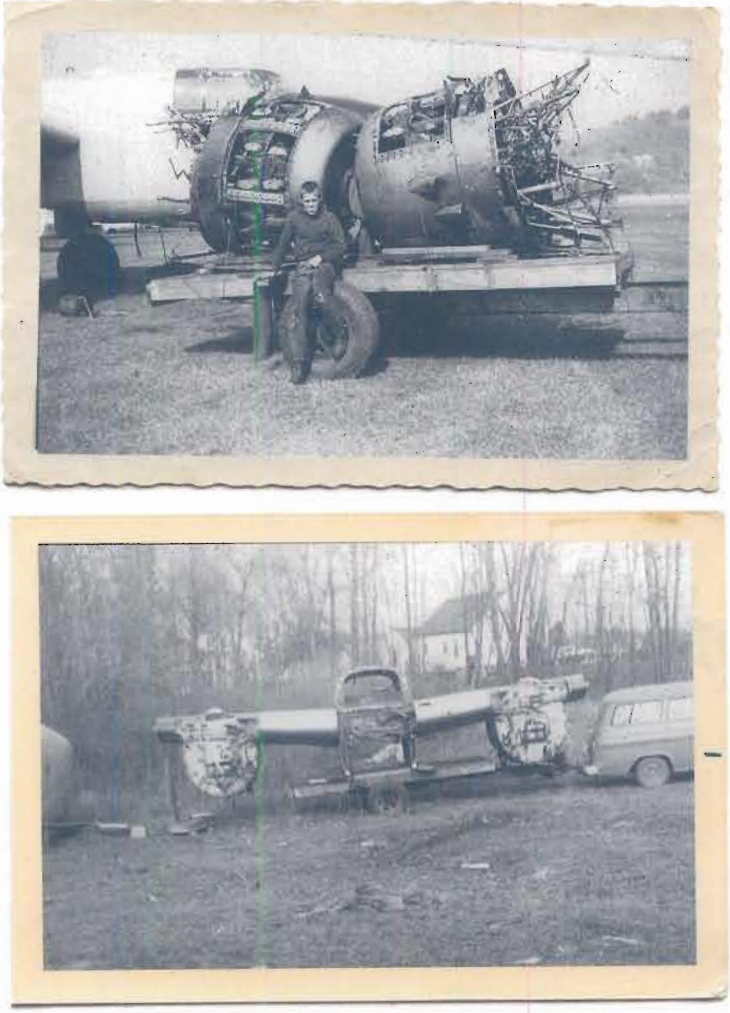
Dad would come to describe this first trip as "the easy load." We removed all the small components— tail section, wing flaps, ailerons, landing gear doors and bomb bay doors—loaded them on the trailer, and took them home.

Dad had picked his words well: Nothing was easy after that. The first major disassembly we tackled was removing the outboard wings. From the outside, the wings looked relatively simple to remove, and Dad took just me to get them.

Along the top and bottom of the wing joint, a long row of bolts stuck into the wing, with their 9/16-inch heads protruding. *Easy job*, we thought. We got on top of the left outboard wing. Dad started on the first bolt, which turned without much difficulty, but that was it. It turned and turned and turned but didn't even begin to come out. He put his socket on another bolt, and another, with the same result. "Don't tell me they didn't put self-holding nut plates inside the wing!" he exclaimed.

We got off the wing, and soon Dad had his wobbly stepladder under it. Good news and bad: An oil cooler was located at each wing joint, with an access panel under the cooler. But the cooler bled thick, black oil when removed, and after the cooler was out, we still could not reach half the nuts for the wing bolts.

Dad cut the rivets that held the air ducts for the oil cooler. With the ducts removed, I was able to snake my skinny shoulders through the oil cooler opening and into the wing. Struggling with claustrophobia, plus the fear I'd get stuck inside the jagged structure, I spent hours contorted in the wing as I moved my wrench from one nut to the next while Dad spun the bolts out from outside.



Wally Soplata, 11 here, recalls his father's device for hauling bits and pieces of the B-25 as "too much airplane and not enough vehicle."

When it came time to pull the last bolts and remove the wing, we had another problem that would confront us on most airplane-hauling endeavors. We didn't have a crane or lift. To solve the problem this time, Dad made a pair of H-shaped wood frames to hold the wing as the bolts were removed. A genius at making a hard job easy by constructing something cheap and simple, Dad connected the H-frames to the trailer in a way that allowed them to fold down to the trailer. Using an old bomb winch to control the rate at which the H-frames folded, we lowered the wing to the trailer. Now we were halfway done with this part of the ordeal.

We worked on the bomber every weekend that October and on into November. Many local aviation enthusiasts stopped by, and from them we learned a lot about the bomber, including the story of how the B-25 had ended up at Lunken nearly two years earlier.

As the story went, a man from Louisiana used the bomber to take a diverse collection of exotic animals from city to city—thus the name *Wild Cargo*. En route to Cincinnati for a show, the right engine had failed. The pilot reported to Lunken Tower that his landing gear was inoperative and declared an emergency. While the pilot circled Lunken to burn fuel, the copilot parachuted out, an event that was captured on camera by local news teams. Despite having an engine out, no landing gear, and an extreme crosswind, the pilot, by all accounts, made a perfect landing.

After the wings, we tackled the rear fuselage. Though it wasn't that heavy, it was so long that we had more fuselage hanging off the trailer than riding on it. Making matters worse, we had the narrow end (tail gunner position) of the fuselage on the front of Dad's two-wheel trailer. Though this arrangement allowed us to get the narrow tailcone up close to the Suburban's rear doors to allow room for turning, it also meant the wide and heavy end of the fuselage was sticking far beyond the back of the trailer. On the highway, the load handled badly and was prone to sway left and right, limiting our speed to about 40 mph.

On another trip, we put both of the airplane's twin-row R-2600 radial engines on the trailer together. Though the load was well balanced, the engines were very heavy. It was bad enough we didn't have a truck, but even worse, Dad's Suburban wasn't too powerful. It sported a straight-six engine with a three-speed transmission that shifted on the steering column; today, people wouldn't use a vehicle like that to pull a jet ski. Here we were dragging a World War II bomber 200 miles.

The last 20 miles of our journey consisted of some big hills in Ohio's Chagrin Valley, and Dad was nervous, with good reason. While pulling the pair of B-25 engines up one of the hills, he had trouble down-shifting into first gear. Halfway up the hill we almost stalled out. With the Suburban built before the age of power brakes and no brakes on the trailer, I later had nightmares about those heavy bomber engines taking us for a rip-roaring backward ride down that long steep hill.

The center section of the wing with both engine nacelles, both main landing gear, and the bomb bay proved to be the heaviest and most unstable load. Still, it represented the last load. Approaching the dreaded hill, Dad shifted into first gear while we were still on flat pavement. To our relief, the Suburban's little six was up to the task, though just barely.

Well past midnight when we got home, Dad cruised from our dirt driveway out into the field next to it. Under the light of the stars, he parked the trailer and center wing behind the cockpit section, to some extent reuniting the shadowy silhouettes. And with that, a stray-dog B-25, once hours away from the scrapman's torch, had found a home.

We hauled airplanes through the early 1970s. We brought home a second, nearly airworthy B-25 in 1966. Also that year, we got a Republic P-47 Thunderbolt fuselage, a North American F-86 Sabre fuselage, and a complete Lockheed P-80 Shooting Star, an early pre-ejection-seat model. Oddest of those we hauled that year, a wrecked B-57 Canberra bomber was dreadfully difficult to dismantle in the bitter cold winter.

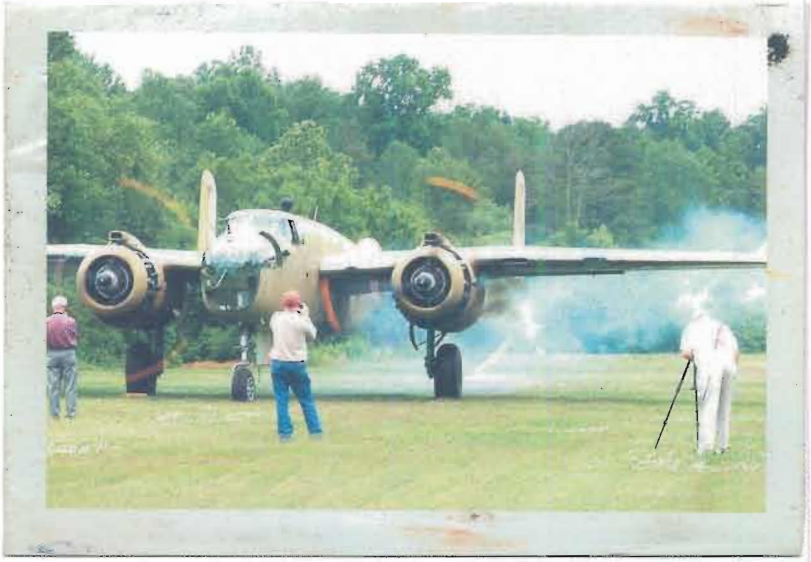
In my father, Mom saw a man driven by a strong work ethic both in his carpenter job and in his passion for airplanes. The only time she put up a fight was over the purchase of yet another FG-1D Corsair in 1960, which was likely the best deal he ever made. He paid $200 for an aircraft in excellent shape. Except for tattered fabric, it was virtually airworthy. Mom had a fit because he hadn't told her in advance. Her first clue was seeing one of the blue outboard wings coming down the dirt road on the trailer behind our clunker Chevy.

Mom has often told me that when women at church ask her why she puts up with her husband's collection, her standard reply is "At least I always know where my husband is."

The year 1966 appeared to be the time when military administrators suddenly discovered they no longer had World War II aircraft for the air museums they were building. Navy and Marine Corps representatives came by, all but begging Dad for his FG-1D Corsair.

Dad was dismayed by the military's lack of foresight, and their stricter regulations. By 1966, surplus military aircraft could not be released to civilians unless they had been demilitarized, which essentially meant cut up into small pieces. Had such a policy existed in the 1940s and 50s, it's likely that Corsairs, Hellcats, and Thunderbolts could have ended up like the Douglas TBD Devastator. Not a single Devastator remains. Thus, despite the wrecked condition of the B-57, and the even worse condition of a Convair B-36 bomber Dad got after the Air Force destroyed, or demilitarized it, he acquired these and other shattered airplanes, to some degree, as monuments to the government's wholesale destruction of its obsolete military aircraft. Dad continues to hang on to the wreckage of two U.S. Navy Blue Angel jets, an F-11 Tiger and F-4 Phantom II, that crashed during airshows.

Wally undoes a B-25 right outboard wing while Walter steps back to document the effort (top). Peggy Soplata (above) tolerates, and Wally admires, an F7U Cutlass that Walter dragged home.


FIGHTER FACTORY

The first of the Soplata aircraft to be sold was the B-25 pictured opposite. Collector Gerald Yagen had it restored in Woodstock, Georgia, where its engines were run up for its first post-restoration flight in November 2005. Over the years, the family's property in Newbury, Ohio (below), became the stuff of legends.

His engine collection numbers 50 or so. He once had the first engine ever made by the Allison Engine Company, which he happened to get when a scrap dealer friend didn't have the heart to scrap the rare engine—he knew Dad would give it a home. It's now on display at the New England Air Museum at Bradley International Airport in Connecticut.

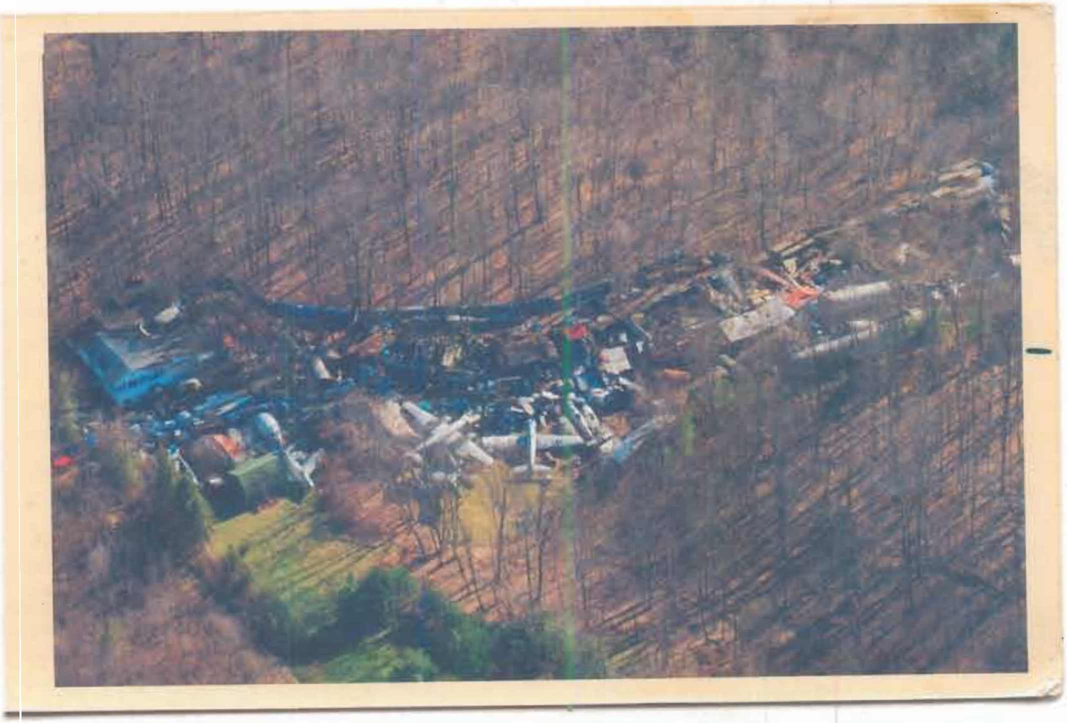
Up through 1972, Dad and I collected aircraft purchased from private individuals, aviation schools, and other non-military sources—a Douglas B-26, two Grumman TBM Avengers, a North American SNJ Texan, a Curtiss O-52 Owl.

The warbird restoration movement picked up steam about then, with others snapping up the last of the cheap and derelict World War II aircraft. Prices skyrocketed, knocking Dad out of the market. Also that year, I enlisted in the Air Force as an electronics technician and a few years later attended Air Force ROTC to become an officer and a pilot, breaking up our father-and-son airplane-hauling team.

On Sunday afternoons in the 1960s and 70s, it was common to have 30 or so visitors touring the Soplata collection. Parents and kids could climb into the cockpits of a BT-13, BT-15, T-50, T-28, SNJ Texan, FG-1D Corsair, F2G Corsair, TBM Avenger, AD Skyraider, F-82E Twin Mustang, P-80 Shooting Star, F-84F Thunderstreak, F-86L Sabre, F7U Cutlass, B-25J, Douglas B-26, and a P2V Neptune. But for the past 20 years, Dad's collection has been closed to visitors. Now 83 and a regular on the flea market circuit, Dad has expanded the scope of his collecting to include anything and everything. To support his perpetual appetite for collecting, many of his aircraft have been sold. The first to go, in 1986, was *Wild Cargo*, which was restored for flight in 2005. It is the first of Dad's refugees to fly again.

The P-80 is owned by the National Museum of Naval Aviation in Pensacola, Florida. The F-82E Twin Mustang is being restored to airworthiness in Minnesota. The F2G Corsair belongs to Cleveland's Crawford Auto-Aviation Museum and is partially restored for static display while awaiting funds for completion. The status of a basket-case P-51 sold in the 1980s remains undetermined.

As Dad's collecting eventually dominated every facet of family life, my sisters and I simply learned to fend for ourselves, finding after-school jobs to pay for things we needed. That said, my sisters and I all agree we are stronger adults, perhaps because of our childhood experience. To this day, we all remain on good terms, with "tolerance" being a word we all know well. There hasn't been a family gathering at my parents' home in over 30 years. There simply isn't room.


JIM HARLEY

The O Prize

NASA

WILL ROCKETPLANE LAUNCH SPACECRAFT FROM OKLAHOMA?

BY MICHAEL BELFIORE

WHEN THE ANSARI X-PRIZE WAS AWARDED IN 2004 to Burt Rutan's Scaled Composites for making the first privately funded manned trips to space, the other teams that had been vying for the $10 million prize money, though no doubt disappointed, kept plugging away at their designs for commercial spacecraft. Some, Rocketplane Global among them, are now racing to be the first to offer suborbital tourist flights; I chronicle these efforts in my recent book *Rocketeers*. Since the book was printed, Rocketplane hit some turbulence on the way toward launching Rocketplane XP, its space tourism vehicle. In August 2006, the company won a contract through NASA's new Commercial Orbital Transportation Services program to develop orbital cargo ships for servicing the International Space Station. Because the NASA money is earmarked strictly for orbital ships, the company began channeling its engineering resources away from the suborbital Rocketplane XP and into an orbital spaceship under development by Rocketplane's newly acquired Kistler Aerospace.

The decision delayed launch of the suborbital vehicle by at least a year; the first flight is now planned for 2009 instead of 2008, and only if the company can raise additional funds. Among the casualties of the work slowdown: chief engineer David Urie, who was laid off last May. The company also says to expect changes in Rocketplane XP. "It will still have the same bizjet look," says Rocketplane's George French, and the mission profile will be the same. As this issue of *Air & Space/Smithsonian* went to press, the company had not released specific information about the modifications.

In the meantime, the contest for the suborbital tourism market has a new entrant. In June, EADS Astrium, a division of the formidable European Aeronautic Defence and Space Company, announced its design for a tourist spaceship. EADS Astrium's vehicle, which has yet to receive a name, will send four passengers and a pilot into space, using twin jet engines to climb to 39,000 feet before firing a rocket engine fueled by methane and liquid oxygen. The design bears more than a passing resemblance to Rocketplane XP. Explains Astrium chief technical officer Robert Lainé: "A self-propelled plane is going to be the best for the operator because then they can fly from [any] airport," with no special launch infrastructure required.

In April 2005, I had dinner with Rocketplane business development manager Chuck Lauer at an Oklahoma City sushi bar, along with the company's Japanese business representative and Reda Anderson, the first person to pay for a ride on the company's commercial spacecraft, Rocketplane XP.

Anderson stabbed a finger at Lauer and said, "You have one year to find me a man."

"Me?" laughed Lauer. "You have to do that."

"I can't do that," said Anderson. "I've tried."

Lauer had just finished describing the marketing scheme he and our other tablemate, Ms. Misuzu Onuki, had hatched: Rocketplane would host the first wedding in space.

Rocketplane XP would be a suborbital vehicle, imparting only four minutes of weightlessness after its rocket engine cut off and it coasted out of the atmosphere at supersonic speed. The bride and groom would have to work fast, and in cramped quarters. The ship would have four seats. The pilot would have his hands full flying it. The bride and groom would ride in the back. That left the right front seat for a priest, rabbi, or justice of the peace. Nevertheless, Onuki had already been collaborating with a fashion designer in Japan on a dress whose white trusses would rise in graceful undulating ripples below the bride's seatbelts when weightless.

Oklahoma needed jobs; young graduates were leaving the state. If companies agreed to be headquartered in Oklahoma and produce jobs, they would get tax credits—cash. Rocketplane called the money the O-Prize.

Much as Anderson liked the idea, she lacked a crucial ingredient: a groom.

At 66, she doesn't look anywhere near her age. Slim and athletic, she smiles easily and laughs often, but steel in her eye hints at the no-holds-barred dealmaking that earned her a minor fortune in California real estate.

After watching Scaled Composites' *SpaceShipOne* rocket into space on June 21, 2004, Anderson couldn't resist the idea of going herself. Only days after that company won the X-Prize, Anderson met Lauer at a space conference, and after Lauer gave her the Rocketplane pitch, she asked for a business card. She wrote "Number one signed customer" on the back of it, signed it, wrapped a dollar bill around it, and handed it back. Lauer later explained, "The dollar made it a genuine contract." Lauer had once been a real estate wheeler-dealer himself; the two spoke the same language.

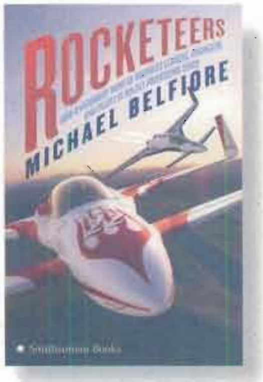
Lauer had always thought that providing tourist flights to space made good business sense, even when it was unfashionable to think so. Back in mid-1995, when he'd co-founded Rocketplane, the prevailing wisdom among rocketeers was that the real money to be made was in satellite launchers. No one would take the company seriously, his board told him, if one of its principals went around talking about sending people into space for fun. Then, in the late 1990s, the bottom dropped out of the satellite launch market, and in 2001, Dennis Tito became the first passenger to buy a ride into space, shelling out $20 million for a trip on a Soyuz spacecraft. Clearly, there was a market for space tourism.

ONE DAY IN APRIL 2006 found Anderson peering down the throat of a sawed-off Learjet 25 fuselage at Rocketplane's workshop at the airport in Guthrie, Oklahoma. Structural engineer Derrick Seys pointed to guidelines marked on the white hull like those drawn on a patient's skin before surgery. He explained how his team would splice in part of another salvaged fuselage to lengthen the original by a good 20 inches—space needed for kerosene and liquid oxygen tanks that would power a 36,000-pound-thrust rocket engine in the craft's tail.

According to company engineer Bob Seto, starting with an existing fuselage made more sense than designing one from scratch. "There's a big cost to designing the details of a fuselage," he said. "Purchasing the fuselage reduced a lot of that risk and development effort. We don't have to spend a large amount of time starting from a blank sheet of paper." Bill Lear's business jet can take 3-plus Gs without breaking up, and has an operational ceiling around 50,000 feet—above 90 percent of the atmosphere.

Rocketplane would replace the Lear's horizontal stabilizers with a V-tail that would better enable the plane's nose to pitch up coming off the runway with a heavy load of fuel. The Learjet's wings would be replaced by a new delta-shaped assembly optimized for supersonic flight, and, like the original wings, holding jet fuel. The wing assembly and tail would also give the ship the extra structural hardiness it needed for the 4-G spaceflight.

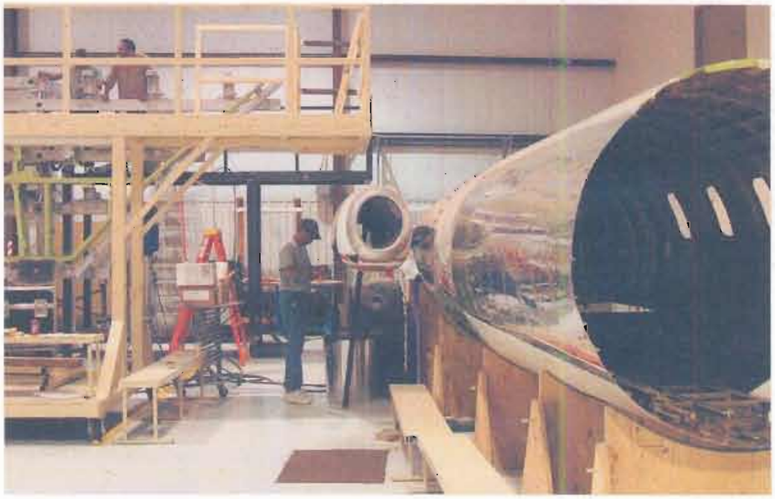
By the time workers finished transforming the gutted shell into the Rocketplane XP, there wouldn't be much left of the Learjet: just that fuselage, or rather two fuselages, and the Learjet 25's standard pair of General Electric CJ610 jet engines. The engines would power the spaceship to a launch altitude of 25,000 feet. There, the pilot would shut down the jets and light the rocket engine for a 70-second boost to space and a maximum speed of three and a half times the speed of sound. After the rocket engine shut down, Anderson would get four min-



This article is adapted from the book *Rocketeers: How a Visionary Band of Business Leaders, Engineers, and Pilots Is Boldly Privatizing Space* by Michael Belfiore. Copyright © 2007 by Michael Belfiore. Reprinted by permission of Smithsonian Books/Collins, an Imprint of HarperCollins Publishers.

Opposite: A computational fluid dynamics image shows how air would behave when Rocketplane XP flies at 2.74 times the speed of sound; red is high pressure, blue is low.

MICHAEL BELFIORE (2)



COURTESY ROCKETPLANE

Rocketplane co-founder Chuck Lauer (above right) hopes his company's spacecraft will make Reda Anderson (top) the first space bride-*cum*-space tourist. Above: a prototype Rocketplane fuselage being cobbled together from two Learjet 25s, which can tolerate 3 Gs.

utes of weightlessness, a view extending as far south as the Gulf of Mexico and west to the Rocky Mountains, and, with any luck, her wedding-day kiss.

A personal display for each passenger would let everyone toggle through views piped in from seven cameras around the craft. For good measure, the pilot would use the ship's reaction-control system (RCS) to roll the craft so all the windows got a good look at Earth.

The Rocketplane XP pilot would navigate the changes in pressure and speed experienced during reentry by using computerized flight controls. And the engineers would give Rocketplane XP at least one advantage over *SpaceShipOne*. As the ship left and then reentered the atmosphere, the XP's computers would blend RCS control with inputs from standard airplane control surfaces, providing seamless control at all phases of the flight. The XP's computers would fly the ship from boost to reentry, with the pilot taking over only in an emergency and for landings. The pilot would restart the jet engines at 20,000 feet for a powered landing. Total flight time: 60 minutes.

The idea had been hatched by Mitchell Burnside Clapp, an aerospace engineer and former test pilot instructor for the Air Force, as a way to get himself to space. While still in the Air Force, Burnside Clapp decided to try to resurrect a perennial Air Force dream: building a manned spaceship the armed forces could call their own. His initial idea was for a single-seat rocketplane, one that could rocket into orbit to launch small satellites.

Burnside Clapp left the Air Force to pursue a commercial version of the ship, forming Pioneer Rocketplane in 1996 with Chuck Lauer and aerospace engineer Robert Zubrin (best known for the concept of manned expeditions to Mars making their own return fuel from elements of the Martian atmosphere). Pioneer Rocketplane set its sights on the X-Prize, but it was chronically short of funds. Zubrin left the company in 1998.

In 2003, the company got a fresh cash infusion from a new president, Wisconsin outdoor advertising businessman and space enthusiast George French, who had been an early investor. As 2003 drew to a close, French, Lauer, and Burnside Clapp saw within their reach a cash award that was worth even more than the X-Prize. They called it the O-Prize.

The state of Oklahoma needed good jobs; young graduates who couldn't find work in the state were leaving to seek work elsewhere. The solution Oklahoma came up with: provide tax credits to technol-

For the first space wedding, the bride and groom would have to work fast. They would ride in the two back seats. That left the right front seat for a priest, rabbi, or justice of the peace to conduct the ceremony during the four minutes of spaceflight.

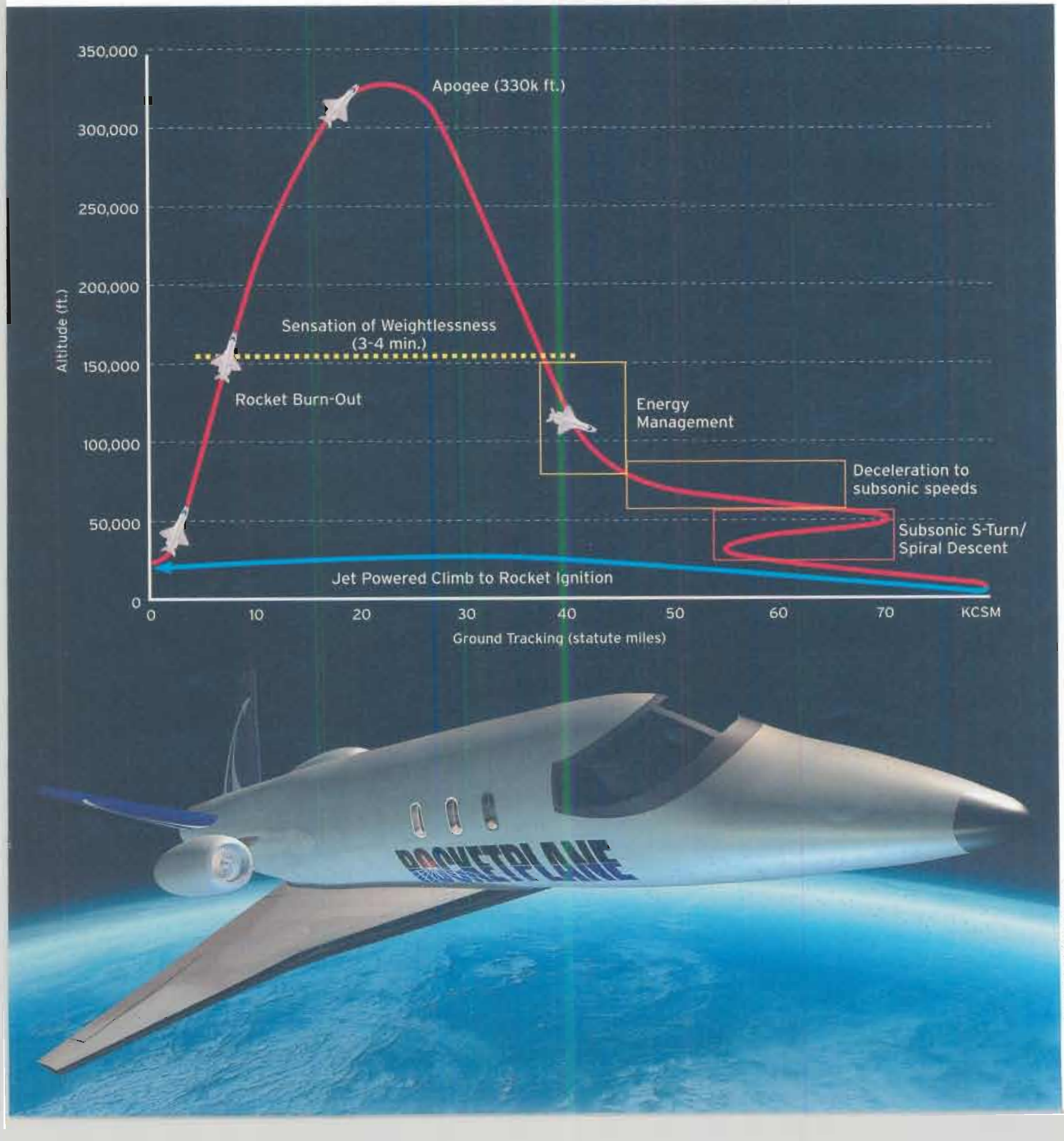
ogy companies. In exchange, the company would have to be headquartered in Oklahoma, have at least $10 million already invested in it, and demonstrate that it really would produce new jobs for the state.

The Oklahoma Space Industry Tax Incentive was worth $18 million in tax credits. The beauty of the credits was that they were transferrable—the company that got them could sell them for cash.

The O-Prize had to be won before 2004. Rocketplane beat out its competitors to win the prize in the final hour: at 4:42 p.m. on December 31, 2003. French then sold the credits for $13 million, and at last the Rocketplane XP had wings.

Early in 2004, French brought in aerospace engineer David Urie to lead the Rocketplane design team. Not long afterward, Burnside Clapp quit the company. " 'Citing creative differences' is the standard Hollywood way to say that, right?" he said to me. He declined to elaborate except to say that he was skeptical of the idea that flying tourists in space was a viable business operation for something as cash-intensive as building and flying a spaceship.

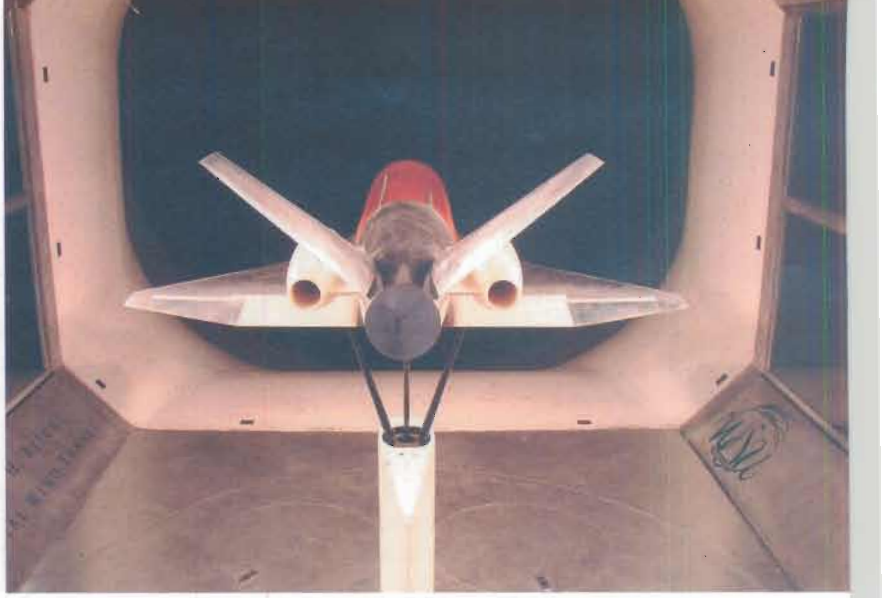
French would have been hard-pressed to come up with a better engineering chief than David Urie. Urie came to Rocketplane after 30 years' experience as an engineer and manager at Lockheed Martin's famed Skunk Works. During his 50 years at aerospace companies like Boeing and Douglas Missiles, he worked



COURTESY ROCKETPLANE

THE PLAN
Two Learjet-standard GE CJ610 engines will take Rocketplane XP from Burns Flat airport (KCSM) to 25,000 feet (blue line). The pilot then shuts down the jets and ignites the rocket engine, getting a 70-second boost to space. After four minutes in space, the craft reenters the atmosphere and glides Earth-ward ("Energy Management"), and at 20,000 feet the pilot restarts the jets for a powered landing.

Former company employee Kiran Pippalapalli prepares to test a Rocketplane XP model in a Huntsville, Alabama NASA wind tunnel (right).



NASA/MSFC (2)

on 35 types of aircraft, from long-haul bombers to missiles. Urie couldn't resist coming out of retirement to work on one last bold aerospace engineering project. The chance to fly into the market under the radars of monolithic aerospace companies like Urie's previous employer was just too good to pass up.

Once settled at Rocketplane's new headquarters, a single-story building at Oklahoma City's Will Rogers Airport, Urie set about hiring a team of engineers composed of equal parts seasoned veterans and young engineers right out of school. One of Urie's prime hires was engineer Bob Seto, who took over the day-to-day operation of building Rocketplane XP. Talking to him made the whole enterprise sound almost reasonable to me.

Seto explained that at a maximum velocity of three to four times the speed of sound, Rocketplane XP wouldn't experience anywhere near the heating from atmospheric friction that the space shuttle, traveling at 25 times the speed of sound, encounters returning from orbit. Nevertheless, reentry heat would pose a problem for an ordinary Learjet's aluminum structure. Aluminum, used for airframes because of its light weight, melts at a lower temperature than a heavier metal like steel.

So Rocketplane's engineers and machinists would replace the areas subjected to the greatest heat—the engine inlets, the nose, and the leading edges of the delta wing—with steel or titanium. The rest of the ship would get a coating of a heat-dissipating paint that had been developed at NASA for next-generation spaceships and that had then been released for commercial use. Even though the bulk of the ship would still be of lightweight aluminum, all those modifications, plus the rocket engine and its fuel, added up to a much heftier craft. At takeoff, Rocketplane XP would top out at 19,500 pounds, compared with the unmodified Learjet 25's 15,000 pounds. The spaceship would need a hell of a long runway to get airborne. Fortunately, the state of Oklahoma had one.

Burns Flat, Oklahoma, is 80 miles from Will Rogers Airport. Bob Seto flew me there, along with Reda Anderson and Misuzu Onuki, in his Cessna 182. He banked on approach so that we could get the best view of the 13,503-foot runway at Burns Flat's former Strategic Air Command base. It had been built during the cold war for heavily laden B-52 bombers ready to scramble at a moment's notice to rain nuclear death on the Soviet Union. Seto remarked that he could take off sideways on it. The place was all but deserted. These days the only traffic the place saw was Air Force pilots practicing takeoffs and landings.

In June 2006, the Federal Aviation Administration certified the place as a commercial spaceport, and it officially became known as the Oklahoma Spaceport. This is where Rocketplane chief pilot John "Bone" Herrington will fly from and land if the spacecraft becomes operational.

Herrington had left the NASA astronaut corps early and taken a pay cut to join Rocketplane. He'd flown in space once, on the last space shuttle mission before the shuttle *Columbia* disintegrated in 2003. He knew he'd likely have a long wait before his next ride on the shuttle, and he just could not pass up a chance to be part of what he thought would be a historic event—the first suborbital flight to carry paying passengers into space.

Anderson grilled

Burns Flat had been built in the cold war for B-52s. These days, the place was practically deserted. The only traffic it saw was Air Force pilots practicing takeoffs and landings. But officially, it was known as Oklahoma Spaceport.

Herrington about the Rocketplane XP's flight profile, about every aspect of the experience of flying in space, about all the potential dangers. And about whether she'd get a good view out the window. "I'm not wild about getting out of the seat and floating around," Anderson told the pilot. "I'm more interested in the view." Fortunately, there just wasn't time to get up and float around and get used to the sensations of weightlessness and take in the sights. The cramped interior of the Rocketplane XP would prevent much floating anyway.

But would Rocketplane XP even get off the ground? Dan Erwin, associate professor of aeronautics at the University of Southern California, thought it had an excellent chance. "The performance numbers given by the company are reasonable, based on their estimate for vehicle mass at launch," he told me. The team's greatest challenge would be the ship's rocket engine.

The AR-36, built by Polaris Propulsion, will run on kerosene and liquid oxygen and deliver 36,000 pounds of thrust. Its regeneratively cooled design (in which kerosene circulates along the combustion chamber's outer wall before flowing inside to be burned) would allow the engine to be fired many times without much maintenance, just like a jet engine. This design had an advantage over rocket engines with ablative coatings, which char and flake away to take heat with them; ablatives have to be replaced after every firing of the engines.

ROCKETPLANE AND RICHARD BRANSON'S Virgin Galactic, which is buying space tourism craft from *SpaceShipOne* builder Scaled Composites, seem to be vying for the honor of flying the first suborbital space passengers. But theirs are by no means the only ventures gearing up for suborbital flights. Scaled Composites' neighbor at the Mojave Airport, XCOR Aerospace, has been working on a two-seat rocketplane design that, like Rocketplane XP, would launch under its own power from a runway but without the encumbrance of jet engines; Xerus would be rocket-powered all the way.

And, working in secret, Amazon.com founder and CEO Jeff Bezos has built a self-funded company, Blue Origin, to produce a suborbital tourist spaceship called *New Shepard* (after Alan B., America's first astronaut). *New Shepard* would take off, send three passengers on 10-minute flights out of the atmosphere, return, and land on its tail. According to Environmental Protection Agency papers he has filed, Bezos plans to launch tourists to space by 2010.

With all this competition, it seems possible that within the next decade or two, suborbital passenger service to space could drop to the cost of an ordinarily expensive vacation—a Caribbean cruise, say. But not all of those passengers would be space tourists. In fact, most of them wouldn't be. "We think that the future for suborbital is really in point to point, both for people and for fast cargo," said Rocketplane's Chuck Lauer.

In other words, the biggest market would be for intercontinental travel at rocket speed.

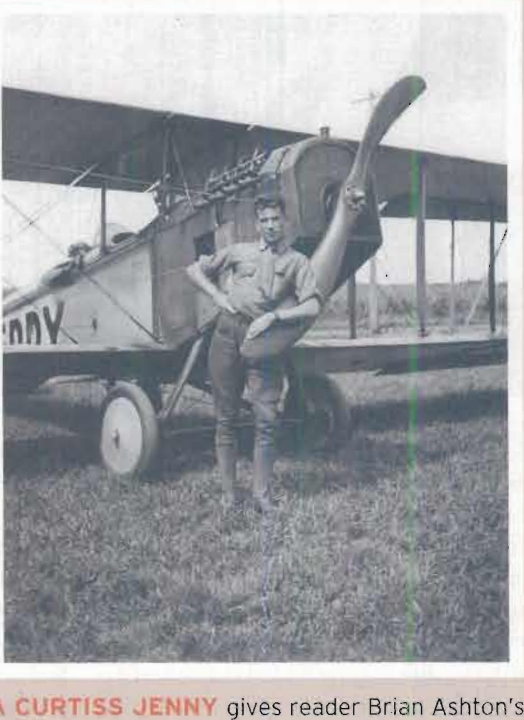
COURTESY ROCKETPLANE

OKLAHOMA SPACE INDUSTRY DEVELOPMENT AUTHORITY

Left: Oklahoma Spaceport, a.k.a. Burns Flat, boasts a 2.5-mile-long runway from which Rocketplane hopes to operate its space tourism business. The pilot will be former astronaut John "Bone" Herrington (above).

Photos from the Attic

Pages from the *Air & Space* Reader Scrapbook.



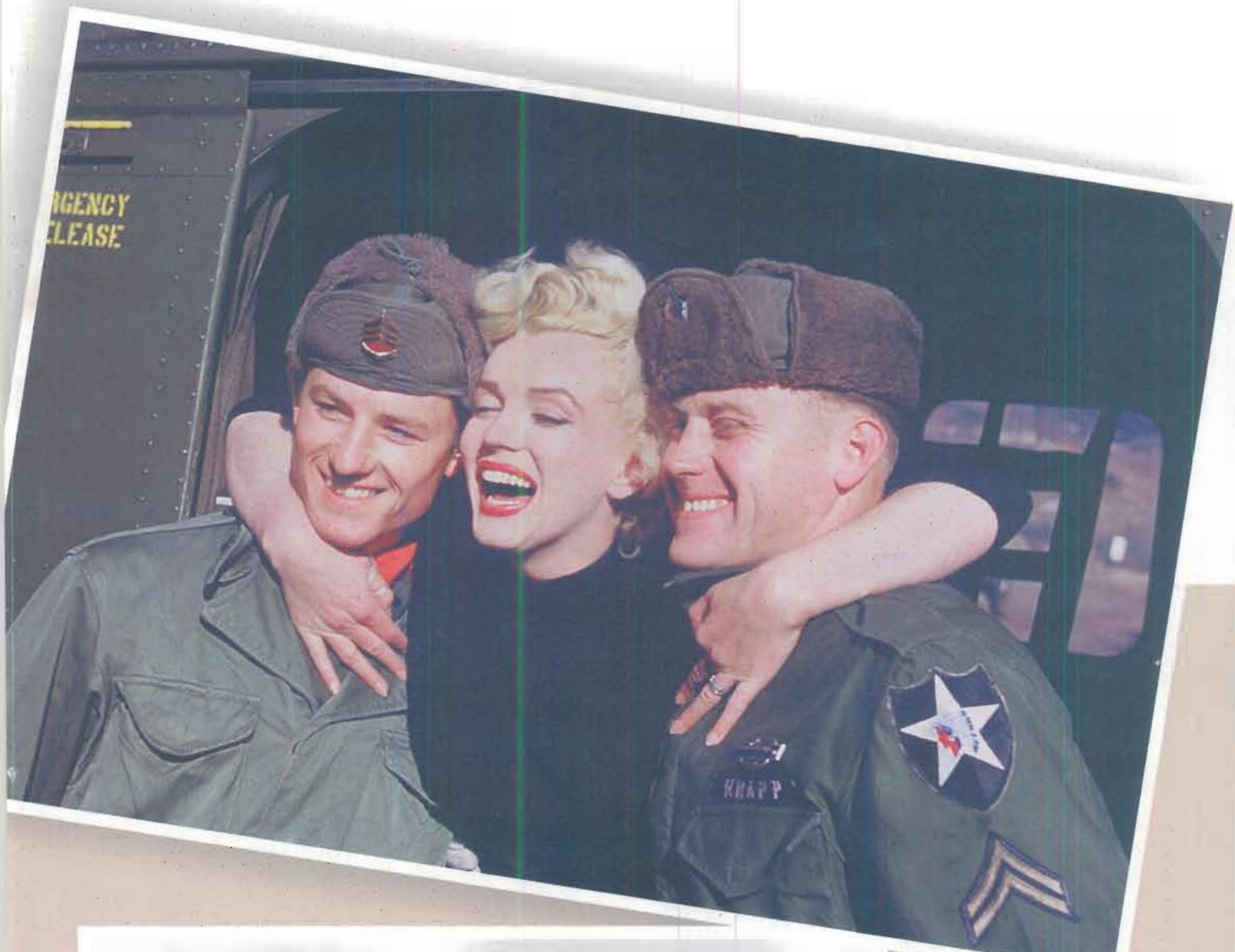
A CURTISS JENNY gives reader Brian Ashton's great-grandfather Burt the chance to strike a pose. Burt worked for the Sperry family, developers of the first airplane autopilots.

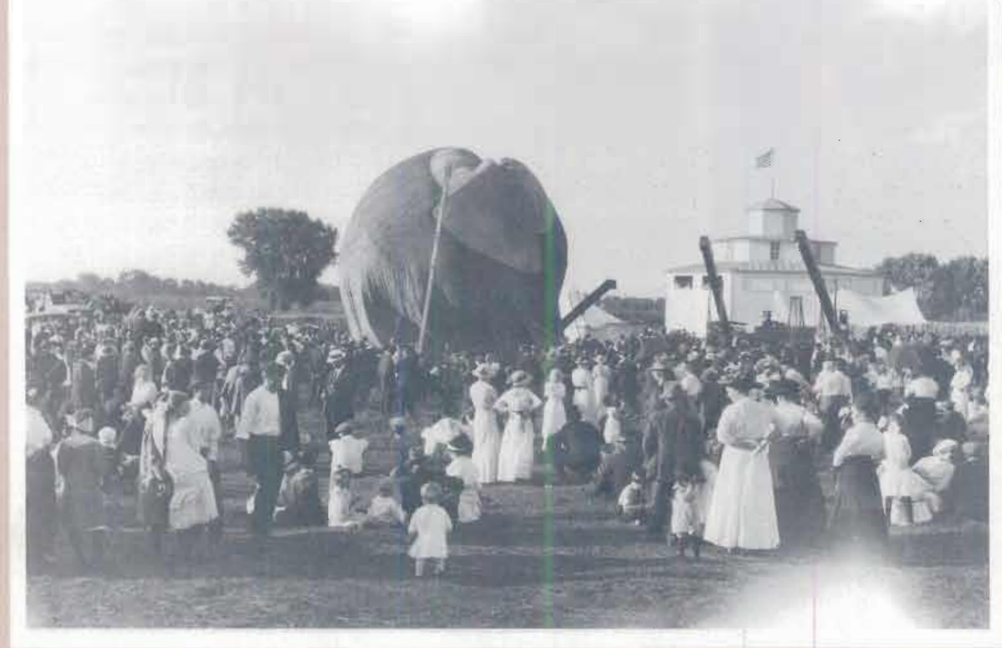
THE WISDOM OF THE CROWD. That's the guiding philosophy of collaborative Web sites like Wikipedia, which put their trust in collective, rather than individual, expertise. We had something similar in mind last fall when we announced the start of our online Reader Scrapbook. We knew that few groups understood flight like the readers of *Air & Space*, so we invited you to send us your photos—of airplanes, pilots, passengers, astronauts—anything to do with flying. Then we sat back and watched the e-mails come in.

Several hundred submissions later, the collection is online at *www.airspacemag.com/scrapbook*, with more photos added each day. A selection will be on display in November at this year's Aviation Nation airshow at Nellis Air Force Base near Las Vegas. As the sample on these pages shows, your snapshots cover flying in all its forms, and remind us again that airplanes, like their owners, have personalities. One day we might receive an elegant photo of a Concorde in flight, the next a quiet shot of a teenage glider pilot nervously anticipating his first solo. You never know what you'll get when you cast the net wide.

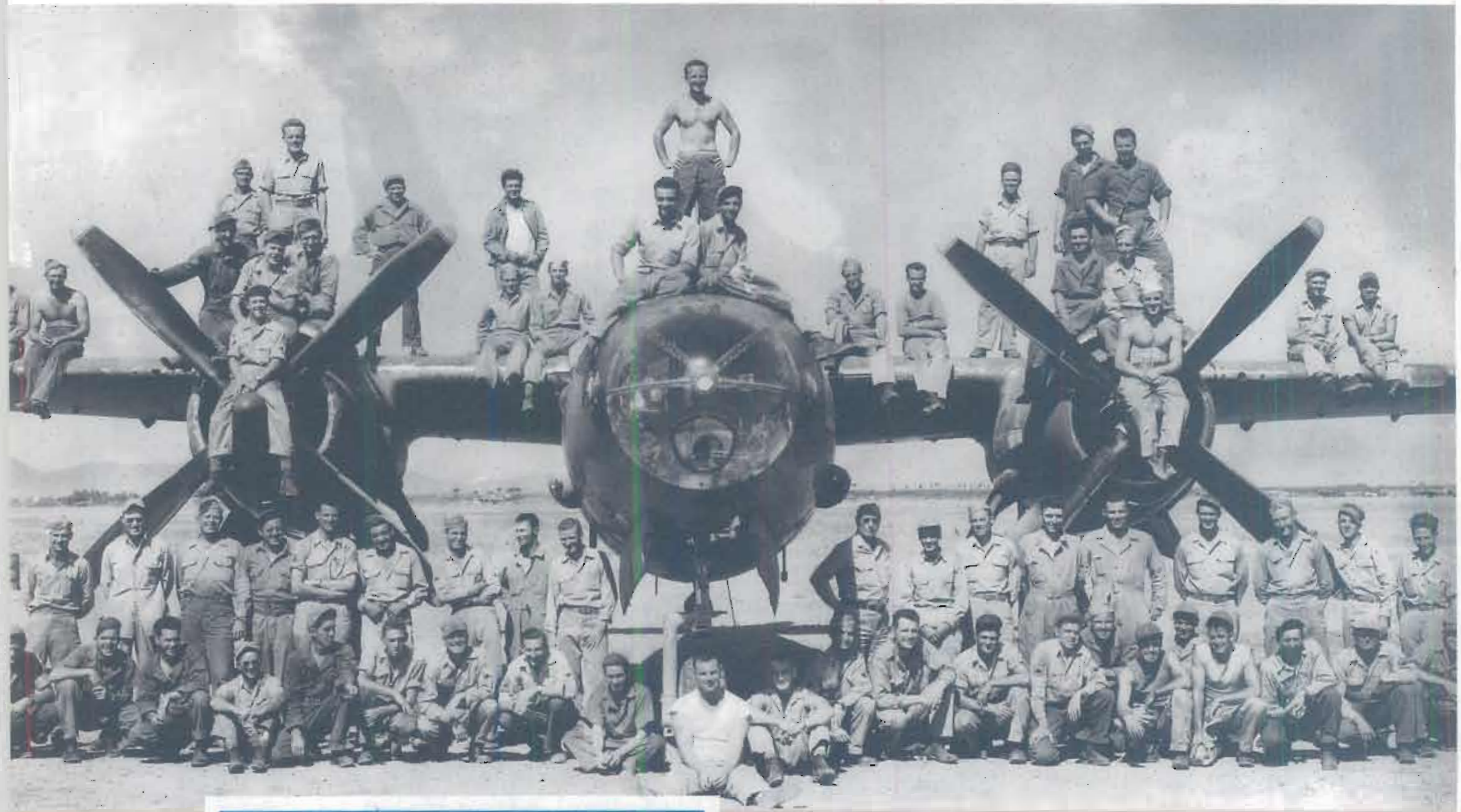
Some pictures come with lots of information, while others are mysteries even to their owners: "I found these in my father's storage closet," say the e-mails, or "My uncle took these photos during World War II, but I don't know where or when."

We've noticed a few gaps—like the Vietnam War, which for some reason has been underrepresented. But in just a few months, you readers already have produced an impressive photo history of aviation, on your own, without any direction or planning. Thanks. And keep 'em coming. —*The editors*

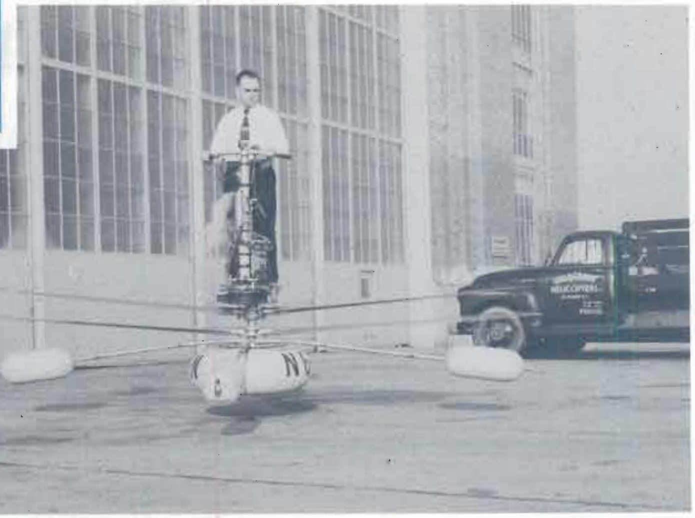




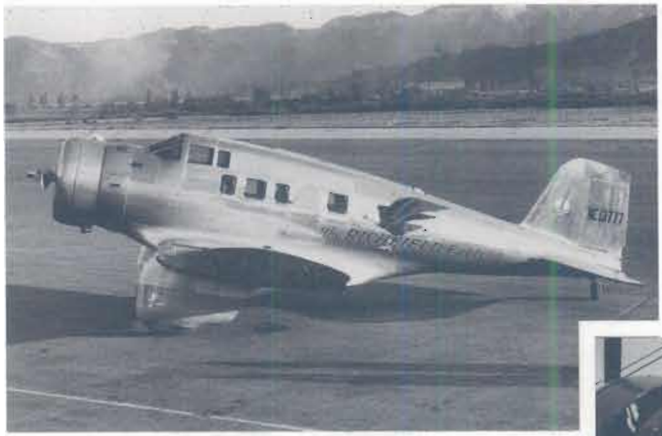
ABOVE: MARILYN MONROE during a 1954 USO stop in Korea. Marvin Wingrove (whose son Pete submitted this rare color photo from that tour) was lucky enough to be one of her helicopter pilots. ■■■ **LEFT: SOUTH DAKOTA,** ca. 1914. Bill Caudry of Simi Valley, California, sent this shot from his father-in-law's collection, showing an early hot-air balloon near Beresford. "The darn thing burned up before it got off the ground," he writes.

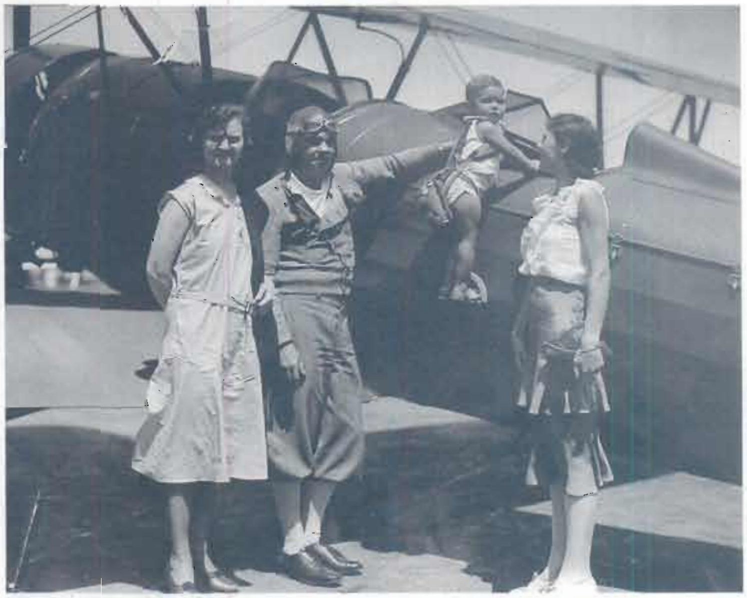


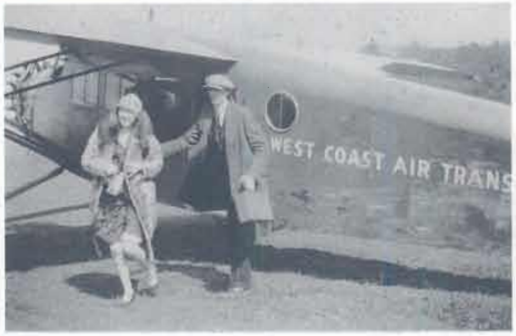
ABOVE: THE 442nd BOMBARDMENT SQUADRON. Merit Christopher's World War II service as a B-26 crew chief inspired nephew Jack Davey of Phoenix, who sent in this picture, to join the Air Force. ■■■ **LEFT: AT THE RENO AIR RACES, 1987.** Hayman Tam of Belmont, California, writes: "Seeing [Lefty Gardner's] Lockheed P-38 in person cemented its place as my favorite airplane." ■■■ **BELOW: BOLLING FIELD, WASHINGTON, D.C., 1956.** One Sunday morning before the crowds arrived for Armed Forces Weekend, Richard Dickson of Epps, Louisiana, got a private demonstration of an amphibious minicopter prototype.

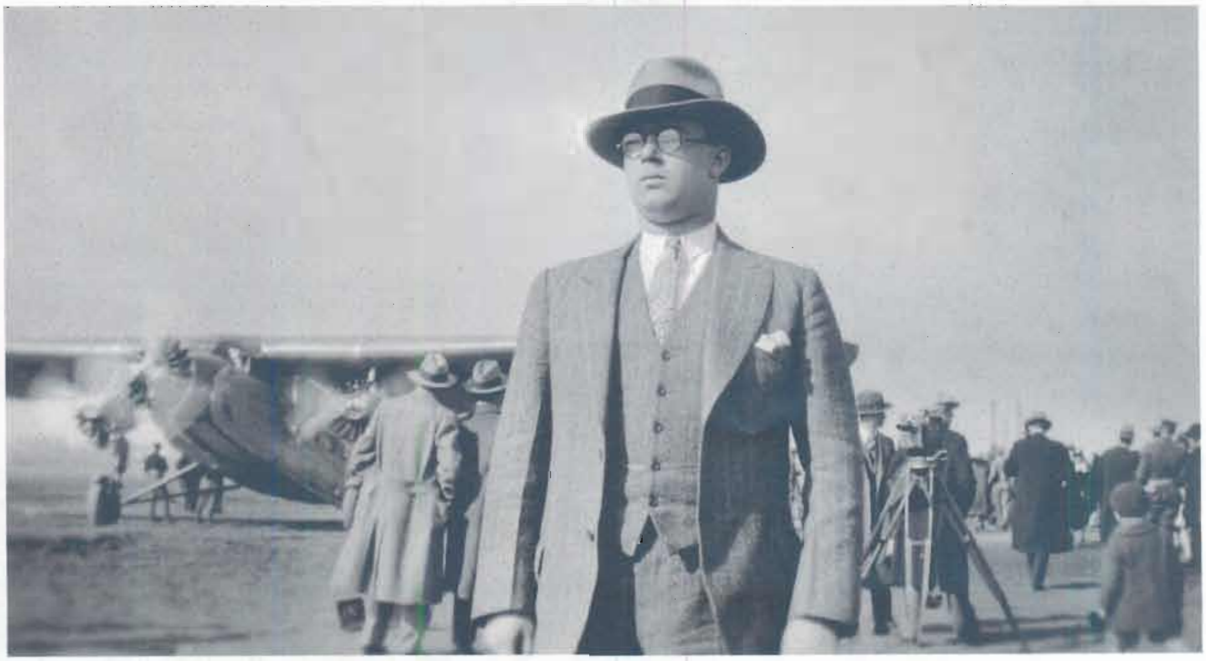


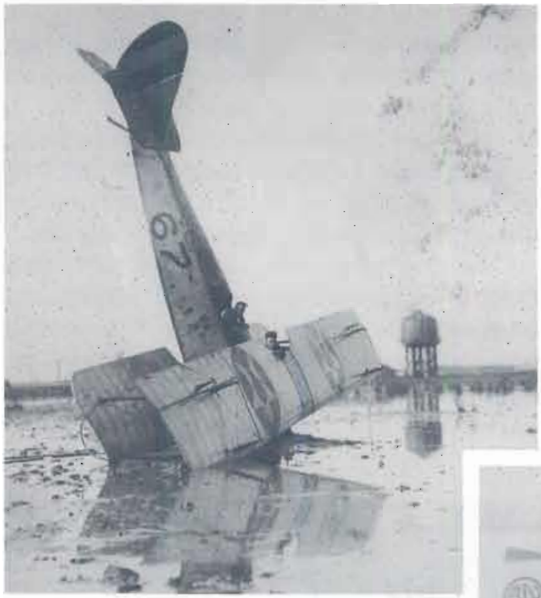
■■■ **LEFT: IN THE 1930s,** Ralph Hall piloted Richfield Oil's corporate jet, the *Richfield Eagle*. His son Ralph (the toddler with the parachute, below) now lives in Elk Grove, California. ■■■ **BELOW, LEFT: AFTER HER FIRST AIRPLANE RIDE** in the 1920s, Elizabeth Edwards of Seattle wrote her cousin: "The ride was marvelous – you should try it!" Her son David still has the note, along with a newspaper clipping about the trip and this photo. ■■■ **BOTTOM: THE CAPTION** accompanying this snapshot, submitted by A.T. Willett III of Tucson, Arizona, reads: "Man pictured in front is [my grandfather] A.T. Willett II at Bolling Field, Washington D.C., May 1929. Charles Lindbergh was flying the Ford Trimotor airplane in the background."

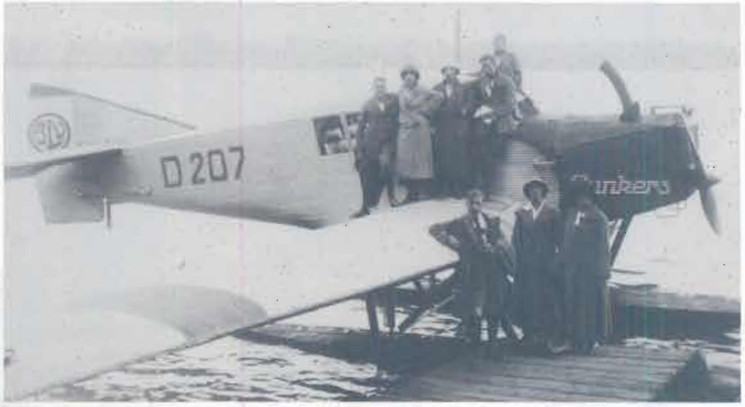


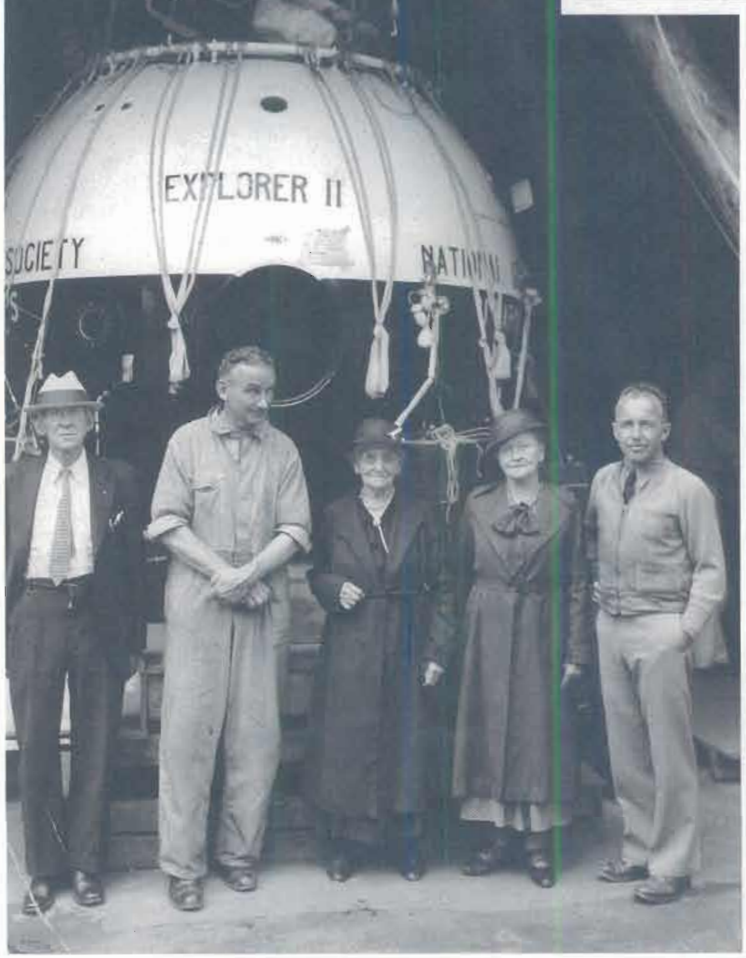












TOP LEFT: EDWARD HAMILTON served in the Army Signal Corps from 1916 to 1920, during which time he amassed a collection of photos that was passed down to his grandson Roger of Shreve, Ohio. No clue as to what befell the unhappy crew of this Curtiss Jenny. ■■■ **ABOVE: FLIPPING THROUGH** his wife's family photo album, Samuel Koeppel of Glen Head, New York, came across a shot of his mother-in-law and friends with a Junkers F-13 in 1920s Austria. ■■■ **LEFT: THE 1935 EXPLORER II** mission was a daring ascent into the stratosphere by Captain Albert Stevens (second from left). Edward Dawson Cochley of Wabash, Indiana, sent this photo of his grandfather, great-grandmother, grandmother, and uncle, who was involved with the flight. ■■■ **OPPOSITE, TOP: WHILE FLYING** helicopters out of South Vietnam during the Vietnam War, Tom Nietsche of Doylestown, Pennsylvania, posed with some of the locals. ■■■ **OPPOSITE: THE CONTROL TOWER** on Treasure Island in San Francisco Bay, mid-1940s. Craig Knight's father, Robert, worked for Pan American at the time.

X-

THE REAL MEN

LIFE CAME AT YOU FAST WHEN YOU FLEW THE X-15.

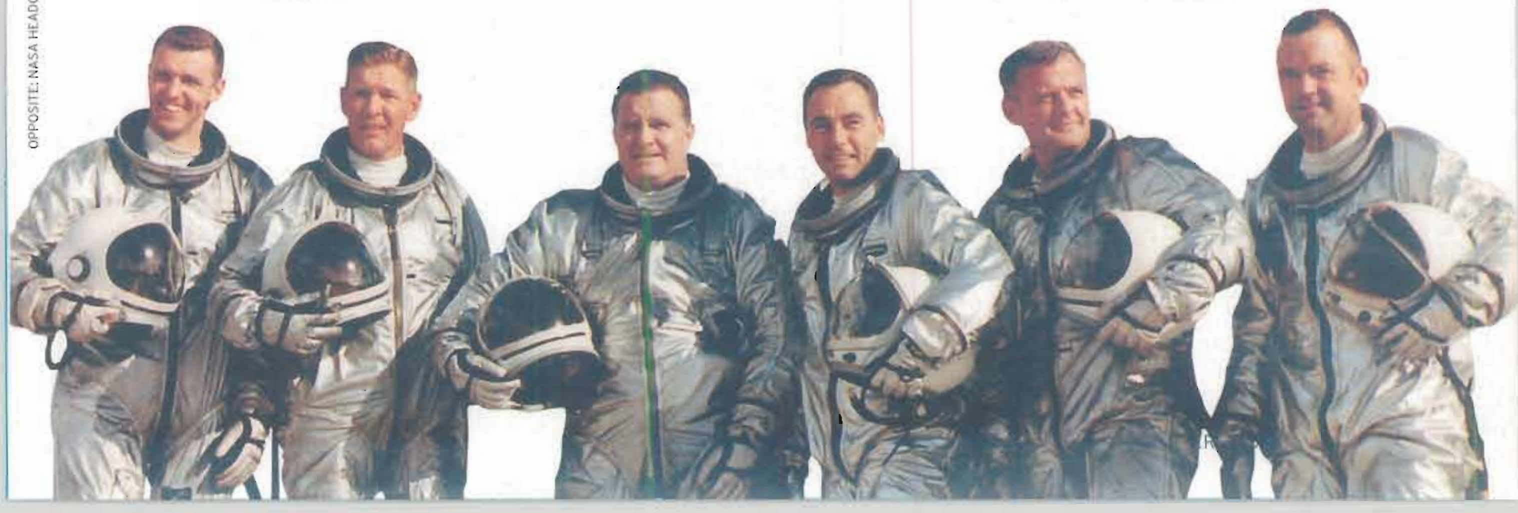
by Peter Garrison

SCOTT CROSSFIELD WAS THE FIRST to fly the X-15, and he probably knew the airplane better than anyone else. He had left his job at the National Advisory Committee for Aeronautics in 1955 and gone to North American Aviation, which had just won the X-15 contract, to bring a pilot's perspective to the design. Crossfield was an extraordinary test pilot, but at the end of the first flight, a seemingly simple power-off glide on June 8, 1959, the airplane tested him.

As he approached the dry lake bed at Edwards Air Force Base in California, he pulled the nose up to slow his descent. The nose came up too far, and he had to push it back down—and now he knew, and watchers on the ground knew, that the airplane had entered a divergent oscillation, galloping along a sine wave that increased in amplitude as Crossfield descended. Another X-15 pilot, Milt Thompson, later wrote that it was "a terrifying sight." Crossfield couldn't stop it, but he managed to get the landing skid on the ground at the bottom of a cycle, saving the airplane and possibly his own life. The problem turned out to be due to a poorly adjusted pitch damper; it was easily corrected.

By the time of that test, Crossfield already had 80 rocket flights under his belt, many in the Bell X-1 and Douglas Skyrocket, precursors of the X-15 that had been investigating supersonic flight since 1947. NACA, after spending eight years working up to the neighborhood of Mach 3 and an altitude of 100,000 feet in a series of barely adequate aircraft, now want-

The fastest airplane ever flown was carried to 45,000 feet by a Boeing B-52 (opposite) and dropped. Then the pilots took over. Left to right: Joe Engle, Robert Rushworth, Jack McKay, Pete Knight, Milt Thompson, and Bill Dana.



OPPOSITE: NASA HEADQUARTERS; BELOW: NASA DRYDEN

NASA HEADQUARTERS

DON CRAVENS/GETTY

NASA DRYDEN

Chief X-15 pilot Joe Walker (left) also flew the X-1—with enthusiasm. Walker was killed in 1966 when the chase plane he was flying collided with the XB-70 bomber. Top left: Though the X-15 was carried on the B-52's left wing for wind tunnel tests, it always flew on the right. Air Force test pilot Bob White (above) and his family in 1962 after his flight to 314,750 feet. Only Walker flew higher: 354,200 feet.

ed the new research airplane to achieve Mach 6.6 and an altitude of 50 miles in a single leap. The X-15 would go where no airplane had ever gone before: into the void beyond the edge of the "sensible atmosphere," where aerodynamics no longer exists, and to speeds at which the heat generated by the friction and compression of the air would melt the customary materials of aircraft structures.

LITTLE WAS KNOWN about flight in the hypersonic range—above Mach 5, or about 3,300 mph. Scanty data had been gleaned in wind tunnels by firing tiny models from guns into fast-moving streams of air. Two things had been learned from earlier rocketplane experience: First, stability—the quality that enables an airplane to be controlled by a pilot—decreased steadily with increasing speed; and second, aerodynamic heating would weaken and distort an airplane's structure in flight. The aerodynamic design of the X-15, and particularly of the all-important tail surfaces on which it depended for both stability and control, was largely a matter of inspired guesswork. Its structural design, on the other hand, involved an immense amount of imaginative and skillful engineering together with novel methods of working with its recalcitrant structural materials: titanium and the heat-resistant hard nickel alloy called Inconel X.

Because he was a pilot, Crossfield's contributions to the X-15's design are often overlooked. Trained as an aeronautical engineer, he injected keen engineering intuition, a grasp of aerodynamics and human factors, and a powerful and decisive personality into a process usually entrusted to non-flying engineers. The result was one of the most successful research aircraft ever built.

North American trucked the first two airplanes—there were three in all—to Edwards late in 1958. For more than a year, teething problems—including an explosion that broke the second airframe in half and a hard landing, which broke it in half again—bedeviled the X-15. Aborted missions far outnumbered completed ones. But in 1960 things took a turn for the better. When, after a series of shakedown flights, Crossfield first turned the airplanes over to the government, they were still temporarily powered by a pair of the Reaction Motors four-chamber engines that had driven Chuck Yeager's X-1 past Mach 1 more than a decade earlier. The total thrust from the smaller engines was just under 12,000 pounds. Crossfield came back that year to test-fly the new 60,000-pound-thrust XLR-99 engine, and then his role in the program ended.

Eleven other pilots flew the X-15. Three opened up the flight envelope: Air Force Major Robert White and NASA's Neil Armstrong and Joe Walker. White was the first pilot to fly Mach 4, 5, and 6, and to surpass 200,000 and 300,000 feet—milestones that the X-15 effortlessly swept aside in rapid succession. Air Force Lieutenant Colonel Bob Rushworth flew the most X-15 flights—34; Lieutenant Commander Forrest Petersen was the only Navy pilot to fly the rocketplane. The other pilots were more or less equally divided between the Air Force and NASA. NASA's Jack McKay, ex-Navy, happy-go-lucky, was the group's "best stick-and-rudder man," according to a number of pilots and program staff. Air Force Captain Joe Engle, who would go on to pilot the space shuttle, startled program director Paul Bikle by rolling the X-15 on his first flight, an unauthorized maneuver. NASA pilots Milt Thompson and Bill Dana both subsequently served as chief engineer at the space agency's Dryden Flight Research Center, Dana retiring in 1998. Major William Knight, known as Pete, set a speed record for airplanes, 4,520 mph, that has never been surpassed. And Air Force Major Michael Adams was the program's only casualty.

Of the 12 pilots, four are still living: White, Armstrong, Engle, and Dana. The most famous, as it turned out, would be

NASA HEADQUARTERS

NASA DRYDEN

From a preflight control room, a technician watches the ground crew prepare the X-15 for flight. Left: Neil Armstrong flew the X-15 seven times and was the first to fly the craft with its new "ball nose." The nose unit had sensors that could measure angle of attack and heading in thin air at altitudes where traditional sensors were useless.

Armstrong, whose trip to the moon eclipsed all of his previous accomplishments. He made seven flights in the X-15, going above 200,000 feet and nearly 4,000 mph before transferring to the space program in 1962.

Armstrong was the most talented engineer in the group, and he occasionally let his intellectual curiosity get the better of his piloting instincts. "He would let things go a little bit farther than, say, Jack McKay might have," says NASA flight planner and stability specialist Bob Hoey. Armstrong made a famous mistake in the program, accidentally bouncing back out of the atmosphere during reentry while focused on a technical question about the behavior of the flight control system. He later told James Hansen, author of the Armstrong biography *First Man*, that he "felt the obligation to demonstrate" every aspect of the control system; he had consulted on its design, and he flew the missions to test it.

He coasted all the way to the edge of the Los Angeles basin before managing to turn the airplane around and land it at Rosamond Dry Lake, miles short of the originally planned landing site. It was jokingly said that on his final approach he cleared the cactus at the edge of the lake bed by a good margin—but only horizontally. It was the longest-duration flight in the X-15 program: 12.4 minutes.

Armstrong had another role in the program: to assist in the development of the High Range, the flight route from Utah to Edwards along which all X-15 flights launched, at 45,000 feet and Mach .7, from a B-52 mothership. Radars and radio stations were placed on mountaintops, and miles-long runways were marked on a string of dry lakes so that an emergency landing site would always be available.

Bill Dana got to know the dry lakes well; the early part of his time in the program was spent setting out smoke flares at landing sites so that the X-15 pilot would know the wind direction. He didn't become an X-15 pilot himself until 1965, but his first memory of the aircraft is much earlier: "I went to work October 1 of '58, and they rolled the X-15 out at LAX [Los Angeles International Airport] on October 15. I got to see it the day after that, and I thought it was the ugliest airplane I'd ever seen. We'd spent our whole careers trying to reduce drag, and now they'd put a vertical tail that was square in the back. So I wasn't too impressed with it until they put the big engine in it, and then it had to command your awe. It was a 33,000-pound airplane with 60,000 pounds of thrust, and it really left the scene immediately when you lit that engine.

"I got to see a lot of launches because I was launch chase, and it never failed to impress me. And I wanted in the worst way to fly the airplane, and eventually I got my chance. We went to ground school for six months. I knew the airplane pretty much backwards and forwards."

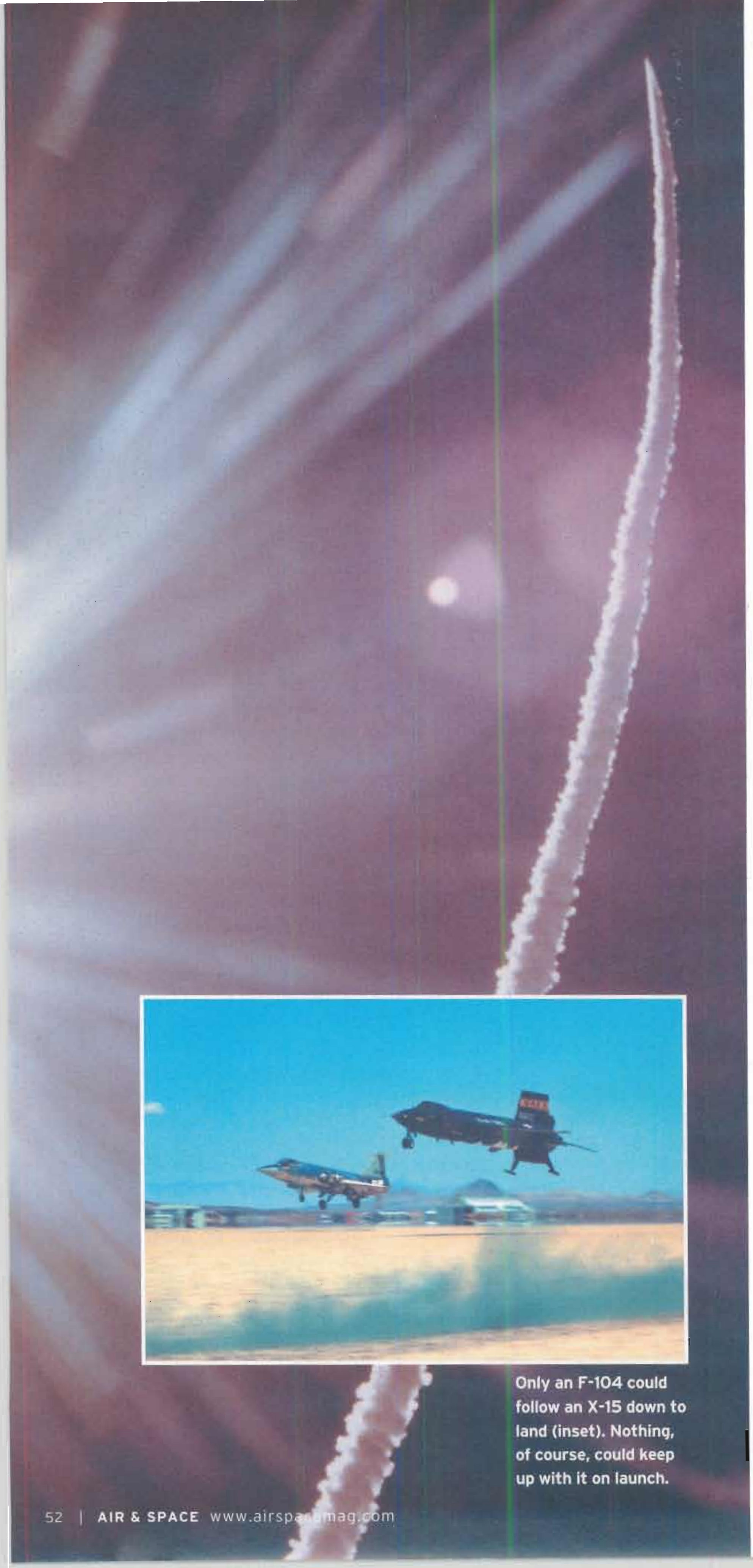
Preparations for flying the X-15, once the pilots were out of ground school, consisted of long periods in the Iron Bird, a simulator in which pilots rehearsed flights over and over. Once every movement of the 10-minute adventure to come was second nature, the pilots ran through strings of unexpected emergencies, as space shuttle crews do today.

"The preparation was intense," recalls Bob White. "We practiced the profile of the mission we were going to fly, and then we threw in failures of some of the rate dampers, the yaw, roll, or pitch damper, and the adaptive flight control system, and then when I was ready I would fly the profile again and they would throw things in unexpectedly I wasn't prepared for."

The part for which no amount of simulator time could prepare the pilots was the steep glide to a dead-stick, or engine-off, landing. The pilots accomplished it with a combination of guidance from NASA 1—a controller on the ground, usually another X-15 pilot—and every pilot's ultimate tool, the eyeball. For every four and a half miles it covered over the ground, the X-15 lost a mile of altitude. Most airplanes were incapable of descending that steeply, but it was found that an F-104—whose general proportions were quite similar to those of the X-15—with its engine throttled back, flaps down, and landing gear and air brakes extended could match the X-15's glide angle at 300 knots (345 mph). Actually, the F-104 could, in a pinch, descend even more steeply than the X-15. The late Joe Walker, asked whether it would be possible to land accurately out of such a steep approach, replied, "There's no question of where you're going to land, it's how hard." In fact, precise dead-stick landings in the X-15 were, in Bob White's words, "a piece of cake."

"We did a tremendous amount of practicing approaches in -104s to the uprange lake beds, and all of the lake beds," says Joe Engle, "because each one of them was different and unique, and the approach was different and your cues were different, and they were different lengths. Some of them were [so short that it was] critical to touch down right at the end."

Bob White worked harder on his landings, he acknowledges, than other pilots in the program: "Joe Walker, he made the first government flight, and Joe landed a couple of miles down from the intended touchdown point. Apparently he didn't work the problem like I did. I took the -104, I would go to different lakes, and you know, engine back in the -104—Okay, here I am, I'm gonna dead-stick—and I set up, and I established all my cues around the landing pattern, and now I was going to make my first flight, and I remember Dick Day, one of the two engineers at Edwards, said, 'Bob, how far from the landing spot do you think you're going to be when you land?' I said, 'I'll be within plus or minus 1,000 feet, no worse than that.'



Only an F-104 could follow an X-15 down to land (inset). Nothing, of course, could keep up with it on launch.

NASA DRYDEN (2)

And he said, 'Oh, I'll bet you a martini.' And I said, 'Make it two.' And he bought me two martinis."

The reentry and glide of the space shuttle resembled those of the X-15, and Joe Engle, who flew both, was the only pilot to hand-fly a shuttle at hypersonic speeds. He recalls the X-15 with evident warmth:

"I really look back on this airplane with fondness. I'm not at all shy or bashful to say that I enjoyed flying the airplane more than any other. If you have a favorite airplane it would have to be the X-15—because it was an absolutely awesome airplane. It was a very ingenious design for its time. It was really very, very advanced. It was a real pilot's airplane; you weren't separated from the airplane by a lot of computers and automatic control systems, and yet you got to fly a very, very impressive profile in both speed and altitude."

FLYING THE HIGHEST-PERFORMANCE aircraft ever built required intense practice, and still there were surprises. The research program moved at a fast pace, and pilots had few opportunities to share impressions that were not related to the research goals of their flights. Milt Thompson was startled by the violence with which the X-15 detached itself from the B-52 mothership, and at finding, on his first flight, that when acceleration from the huge engine pinned him against his seat, he could no longer scan the instruments in the way he had developed while slouched comfortably in the simulator. Other pilots must have experienced the same thing, but no one had warned him.

"There's some professional pride there," Bill Dana comments. "You don't want to help the other guy do too good a job on his program. I never worried about that—I was never in it for the reputation. But a lot of people did."

In the chase for records during the X-plane era, some test pilots clearly focused on their own achievements. But Joe Engle remembers the experience differently. "The real thing I'm grateful for is to have gotten to be part of the X-15 program," he says. "The X-15 program had—I don't want to sound gooey about it—almost a family attitude about it. Everybody there was family, you weren't holding back from anybody.... Among the pilots there wasn't any competition, everybody had the ultimate design limits in mind, and to be part of that climbing-the-mountain process made everybody part of the same team. I would love to do it again."

One thing most pilots remembered in the same way: the hard physical work of flying the airplane.

"You're talking about the change in the acceleration as you continue to accelerate faster," says Bob White. "Going from Mach 2 to Mach 3 took so many seconds, 3 to 4 took less, 4 to 5, you're cutting down, and the pressure on your chest, you get up to the point where you've got 4 Gs and it's difficult to breathe. And so as Milt said it was the only airplane he ever flew where he was glad when the engine quit."

As fuel was consumed and the airplane grew lighter, acceleration increased, and all the X-15 pilots experienced a peculiar illusion: the sensation that although they were holding a steady pitch attitude—a 30- to 40-degree climb—the airplane was actually continuing to climb until it was rotating over onto its back. White himself once failed to make his planned altitude because the illusion of over-rotating was so compelling that he had to push the nose down momentarily in order to glimpse the horizon.

Flights were extremely short—usually 10 or 11 minutes from B-52 to lake bed.

"The time went by like a flash," says Joe Engle. "I remember counting down the last minute of countdown. There are certain things you do and check-list and hitting the release button [to detach from

NASA HEADQUARTERS

Air Force pilot Michael Adams (right) died in the X-15 program's only fatal crash (left). Scott Crossfield was luckier. His emergency landing broke the back of the number 2 ship, but he wasn't injured and the airplane was repaired.

NASA DRYDEN (2)

First among equals: "I'm an aerodynamicist," Crossfield (left) once said, "and flying to me is not an end but a means to designing better performing aircraft." At North American Aviation, as the pilot consultant on the X-15, he helped design a 50-foot-long, stubby-winged, needle-nose rocketplane (above), the highest performing aircraft in history.

BILL BRIDGES/GETTY

the B-52] and then from then on, right after the flight I would have been hard-pressed to go into a lot of detail, between that and the time when you finally slid to a stop and cracked the canopy.

"The other thing I do recall is that the cockpit and the suit were pressurized with liquid nitrogen that could be released through a valve. Cooling was the same way: You just opened up the valve to cool it down. Some of it I'm sure is because the skin would heat up in flight, but I recall turning it up, because everybody said turn it up all the way before you launch, and being almost cold, you know, and then again, this flight going by like the snap of a finger, and sliding out on the lake bed and cracking the canopy, wanting to get it open because I was just drenched in sweat."

Ships 1 and 2 had conventional controls, plus a three-axis stability augmentation system, which would weakly counteract any unintended motions in pitch, yaw, or roll. Ship 3 had the fly-by-wire adaptive flight control system that Armstrong helped design. The system had two purposes: to make the airplane handle similarly in all flight regimes, and to seamlessly integrate the thrusters, used during the weightless coast above the atmosphere, with the aerodynamic controls. It was thought that the airplane might not be controllable during reentry without artificial stability augmentation until Pete Knight experienced a total electrical failure.

"Pete Knight was the best test pilot that I've seen," says Bill Dana. "He had a flight that launched over Smith's Ranch and headed for Edwards. At 100,000 feet and Mach 4, both his generators went offline. All the lights came on for a few seconds, and then they all went out. And he never had another electron, that he could see, in the whole flight. He flew the climb using ballistic controls to keep the wings level. He didn't have an artificial horizon, but he could apparently see out. He kept the wings level over the top and then he wanted to get back to Mud Lake to land there, because it's a long runway. So he made a 180-degree turn to the left and he used more back stick when he wasn't developing wing rock or lateral-directional instability, and when the airplane was flying too squirrelly he backed off on the G and he came around, and now he had aerodynamic controls—he had reentered, in other words—and so he flew a dead-stick landing into Mud Lake. To me, that's the greatest single feat of airmanship that I know of."

Malfunctions as severe as Knight's were rare, but if the X-15's pilots felt anxiety, it probably would have been over that sort of thing—being left helpless out at the edge of the world to be burned up or torn apart by an airplane that had turned savage. Says Bob White: "If you didn't have a little fear when you stepped into this thing, there was something wrong with you, believe me."

Milt Thompson was the only pilot to write a book about flying the X-15 (*At the Edge of Space*, Smithsonian Institution Press, 1992), and because writing about it forced him to turn it over and over in his mind and examine, as writers will, all the feelings that it brought forth, he clothed his memories in metaphor. He described the airplane as a "black bull," and even imagined a scene in which a young warrior is sent out to explore a mysterious land, clad in armor and mounted on just such a beast. "Beware of the bull," the tribal elders tell the young man as he is about to set out. "He is awesome in battle. However, if you lose control of him or fall off, he will kill you as quickly as he would kill your enemy."

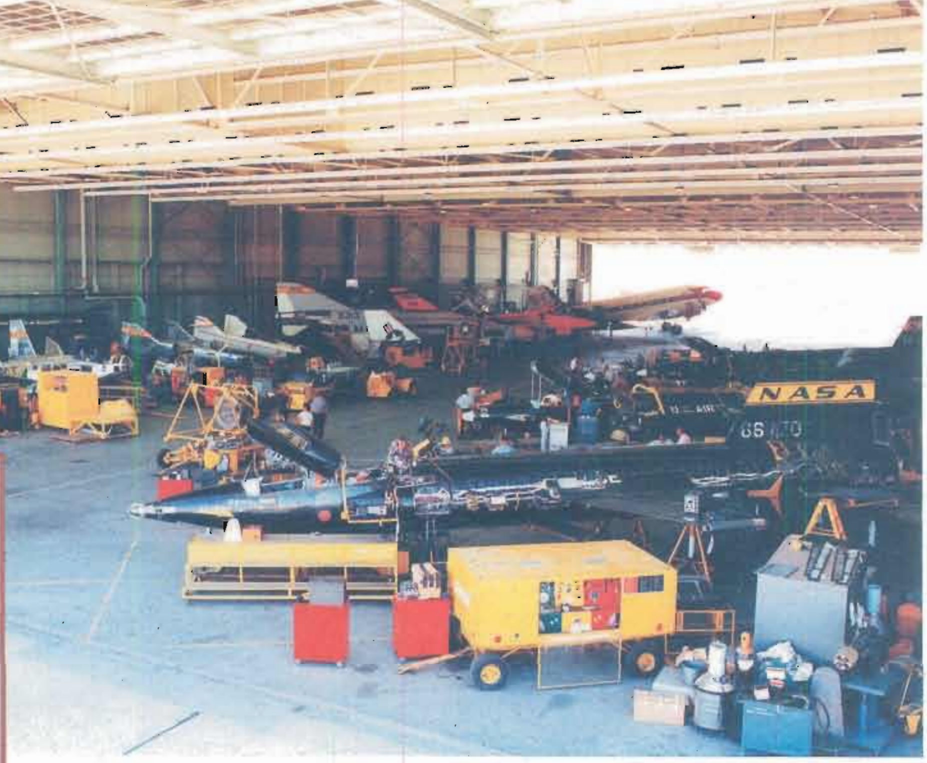
Though Bill Dana and Milt Thompson were close friends, "I didn't understand that part," Dana says. "I don't know what he was trying to get across. I didn't think it was dangerous until right toward the end of the program."

That was when the long lucky streak ended.

X-15s had never been reliable airplanes. They were complex and novel, and on most flights one system or another would act up. But they had always brought their

NASA DRYDEN

BETTMANN/CORBIS



NASA DRYDEN

Left: Pete Knight is helped from the cockpit after the record 4,520-mph dash on October 3, 1967. Above: The three X-15s (at right) shared a hangar with lifting bodies (first three on left) at Edwards Air Force Base during the golden age of flight research.

pilots back alive, no one had ever had to eject, and only one pilot, Jack McKay, had been seriously injured. Even McKay—who was measurably shorter after suffering several crushed vertebrae when a landing skid failed and his airplane flipped over—eventually returned to fly the X-15 again. But Mike Adams didn't return.

It happened in the Number 3 airplane, the one with the adaptive flight control system, which constantly adjusted the authority or "gain" of the controls in order to make the airplane feel the same regardless of speed and altitude. It was the latter phase of the program, by which point the original research goals had all been met and the X-15s were being used as mules to carry scientific experiments to extreme speeds or altitudes. An electric motor that was part of an experiment carried on the wingtip created a disturbance that interfered with the flight control system as the airplane shot out of the atmosphere. Adams, whose known susceptibility to vertigo had been ignored when he was assigned to the X-15 program, apparently became disoriented. An additional trap lay in wait: A needle on his primary attitude indicator could be selected to display either roll or yaw. Adams got mixed up and tried to correct with yaw for what was actually a roll cue. Controllers on the ground could not tell what was happening, but the airplane was rotating about its vertical axis until, when it reentered the atmosphere, it was flying sideways. A violent and dizzying ride followed. Adams reported that he was in a spin—a situation that had never before been encountered in hypersonic flight, and for which no recovery procedure was known. At first, however, the black bull corrected itself, its rotation slowing as it weathercocked back into alignment with its flight path. For a brief period it was inverted but stable, with sufficient altitude for a recovery.

But then the adaptive flight control system began pitching the aircraft up and down with increasing violence until, somewhere beyond 8 Gs, the airplane broke apart. A switch on the panel could have shut the runaway system off, but no one thought of it until too late.

"I have always associated the end of the program with Mike's accident," says Bill Dana. "We were going along with three airplanes, getting lots of data, and had lots of plans. And when Mike was killed, it kind of took the heart out of the program. And I think there were a lot of people that would have liked to quit the program right there. I think the program quit itself. You can imagine the emotion involved there, when Mike got killed."

But it did not end immediately.

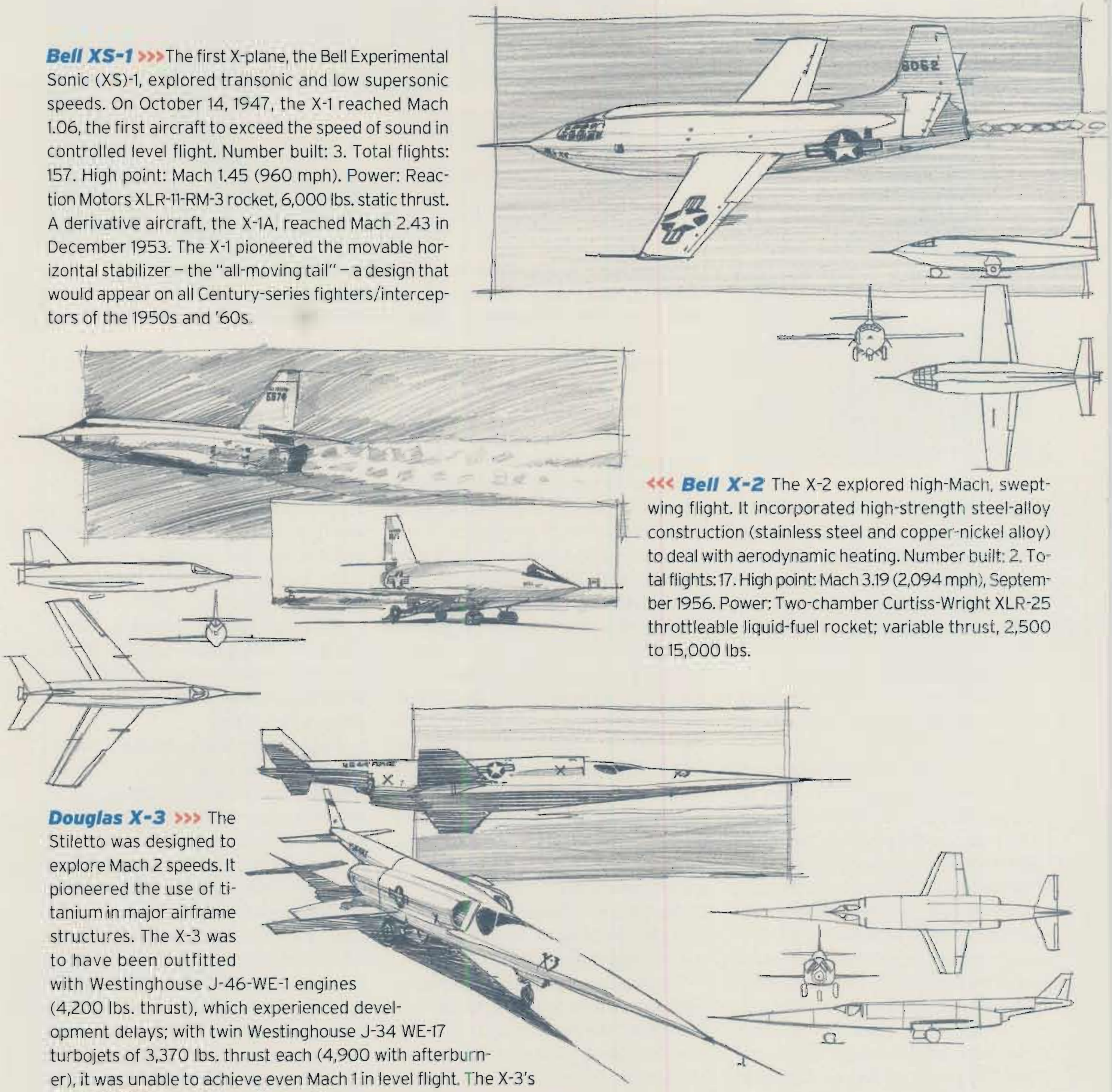
"Paul Bikle wasn't for canceling programs when they got tough," Dana continues, "and so he said we're going to fly one more year, one more calendar year, and that was 1968, and that was what we flew—we flew eight flights in 1968, and that was the end of the road."

Bill Dana was the pilot on the last of the X-15's 199 flights. Freakish weather, including a snowstorm, frustrated several attempts to make it a round 200 before the program ended.

Today the first X-15 hangs in the Smithsonian's National Air and Space Museum; the second X-15, the fastest airplane ever flown, is at the National Museum of the U.S. Air Force in Dayton, Ohio.

It would be difficult to overstate the X-15's importance in the history of flight. It is the keystone of the bridge between Earth and space. It was, in a way, the ultimate airplane: No other airplane has ever approached its performance, or needed to. The X-15—a simple, direct, straightforward machine in the classical tradition of aeronautical engineering—had leaned on the door to hypersonic flight, and the door had swung open. After the X-15 came spacecraft and computers—and a new and alien era in flight.

THE NEED FOR



Bell XS-1 >>> The first X-plane, the Bell Experimental Sonic (XS)-1, explored transonic and low supersonic speeds. On October 14, 1947, the X-1 reached Mach 1.06, the first aircraft to exceed the speed of sound in controlled level flight. Number built: 3. Total flights: 157. High point: Mach 1.45 (960 mph). Power: Reaction Motors XLR-11-RM-3 rocket, 6,000 lbs. static thrust. A derivative aircraft, the X-1A, reached Mach 2.43 in December 1953. The X-1 pioneered the movable horizontal stabilizer – the "all-moving tail" – a design that would appear on all Century-series fighters/interceptors of the 1950s and '60s.

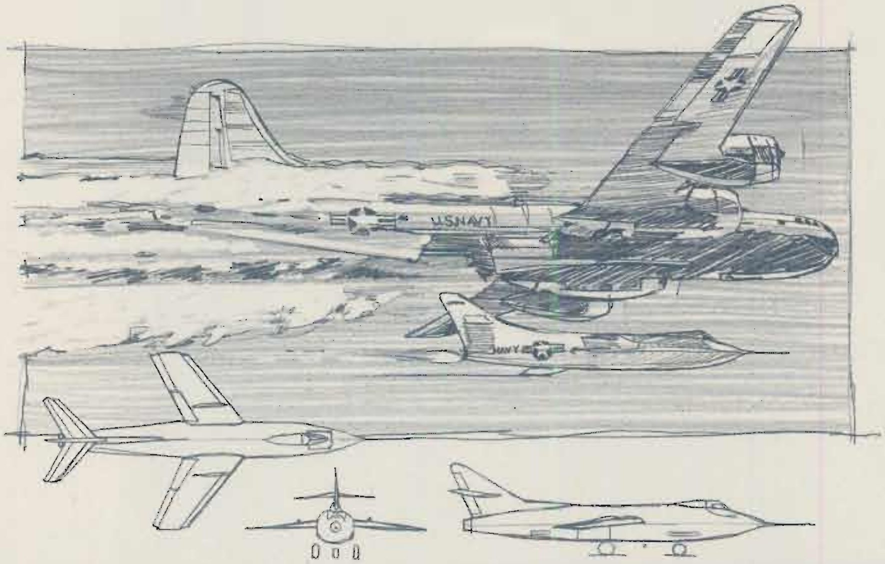
<<< **Bell X-2** The X-2 explored high-Mach, swept-wing flight. It incorporated high-strength steel-alloy construction (stainless steel and copper-nickel alloy) to deal with aerodynamic heating. Number built: 2. Total flights: 17. High point: Mach 3.19 (2,094 mph), September 1956. Power: Two-chamber Curtiss-Wright XLR-25 throttleable liquid-fuel rocket; variable thrust, 2,500 to 15,000 lbs.

Douglas X-3 >>> The Stiletto was designed to explore Mach 2 speeds. It pioneered the use of titanium in major airframe structures. The X-3 was to have been outfitted with Westinghouse J-46-WE-1 engines (4,200 lbs. thrust), which experienced development delays; with twin Westinghouse J-34 WE-17 turbojets of 3,370 lbs. thrust each (4,900 with afterburner), it was unable to achieve even Mach 1 in level flight. The X-3's contribution resulted from its insufficiencies: Instability during abrupt rolling maneuvers led to studies of inertial coupling. With a takeoff speed of 260 mph, the tires often exploded, which led engineers to revise design criteria for tires on high-speed aircraft. Number built: 1. Total flights: 51. High point: Mach 1.21 (in a dive), July 1953.

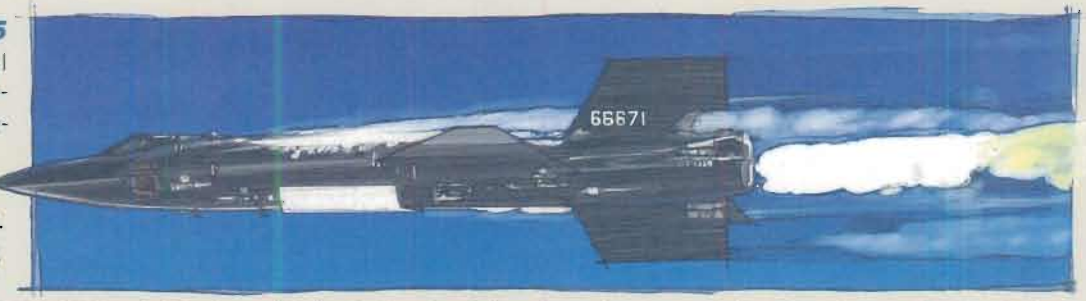
SPEED

SIX AIRCRAFT, ONE MISSION: FLY FASTER.

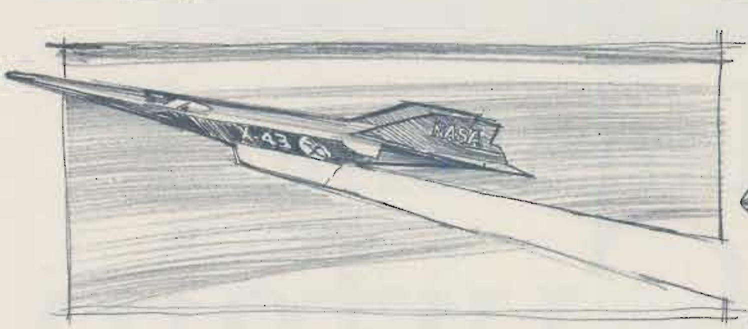
by Patricia Trenner
Illustrations by Harry Whitver

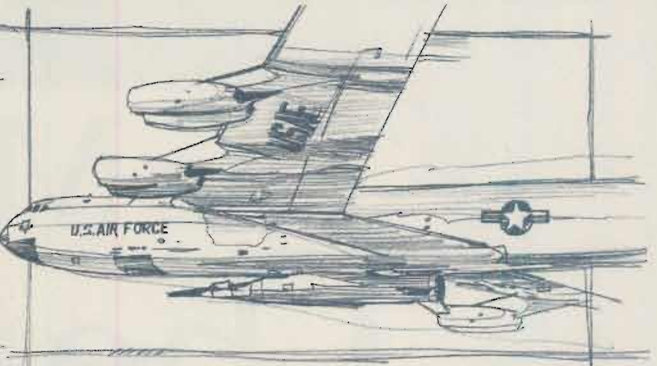


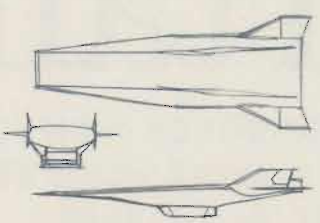
‹‹‹ ***Douglas D-558-II*** The Skyrocket investigated swept-wing performance – in particular, the tendency of the nose to pitch up – with a combination of turbojet and rocket engines. In November 1953, it became the first aircraft to exceed Mach 2 (Mach 2.005 in a shallow dive; 1,291 mph). Number built: 3. Total flights: 312. Power: Reaction Motors XLR-11 rocket (6,000 lbs. thrust) and Westinghouse J-34-40 turbojet (3,000 lbs. thrust). Constructed of aluminum and magnesium, the D-558-II was converted to all-rocket propulsion in 1950.



North American X-15 ››› The most successful X-plane researched hypersonic flight in the upper atmosphere, bridging the gap between atmospheric flight and spaceflight. Number built: 3. Total flights: 199. High points: Mach 6.7 (4,520 mph) October 1967; 354,200 feet (67 miles) altitude. Its titanium internal structure was clothed in an Inconel X (a hard nickel alloy) skin. Power: Thiokol/Reaction Motors XLR-99, 57,000 lbs. thrust; reaction control thruster rockets in nose and wings for near-spaceflight.







‹‹‹ ***NASA X-43*** The ATK-GASL (formerly Microcraft) unmanned X-43 demonstrated an airframe-integrated supersonic combustion ramjet – a scramjet – at hypersonic speeds in exploring an alternative to rocket power for space vehicles. High point: Mach 9.8 (7,000 mph), November 2004. Once a scramjet is accelerated to Mach 4 by a conventional jet engine or booster rocket, it can fly perhaps as fast as Mach 15 without the need to carry an oxidizer tank. A scramjet engine, with no moving parts, compresses the supersonic air flowing through it, which ignites hydrogen fuel in a process NASA calls "lighting a match in a hurricane."

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The Man Behind The Curtain

ALTHOUGH SPACE CZAR SERGEI KOROLEV WON FAME FOR THE LAUNCH OF SPUTNIK, A MORE MODEST GENIUS DESERVES THE CREDIT. **by Asif Siddiqi**

Over the past few years, I have tried to reconstruct the life of Mikhail Tikhonravov, one of the most puzzling figures in the Soviet space program. Although few Westerners have heard of him, it is quite likely that without him, the Soviet Union would not have inaugurated the Space Age 50 years ago this October. Tikhonravov (pronounced "Tee-kun-RAFF-off") had a hand in most of the critical events in the history of his country's space program. He designed the first Soviet liquid-propellant rocket, he proposed the clustered-booster idea for the famous R-7 rocket, he oversaw the design of Yuri Gagarin's Vostok rocket, and he supervised the development of the first Soviet moon probes. He even coined the word "cosmonaut."

But perhaps his greatest triumph was Sputnik, the world's first artificial satellite, which was launched on October 4, 1957. Over the years, much of the credit—some might say too much—has gone to Sergei Korolev, Tikhonravov's friend and the chief designer of the rocket that lofted Sputnik into orbit. But Korolev couldn't have created Sputnik. He "needed a visionary like Tikhonravov," Sergei Khrushchev, whose father, Nikita, led the Soviet Union during that time, once wrote in an essay. "Together they constituted the 'critical mass' that shook the world."

Throughout his life, Soviet space designer Mikhail Tikhonravov (opposite, left) never got the credit or acclaim accorded to Sergei Korolev, his friend. Ten years before they launched the world's first satellite, the two paused in front of a bust of Konstantin Tsiolkovsky, considered the father of cosmonautics.

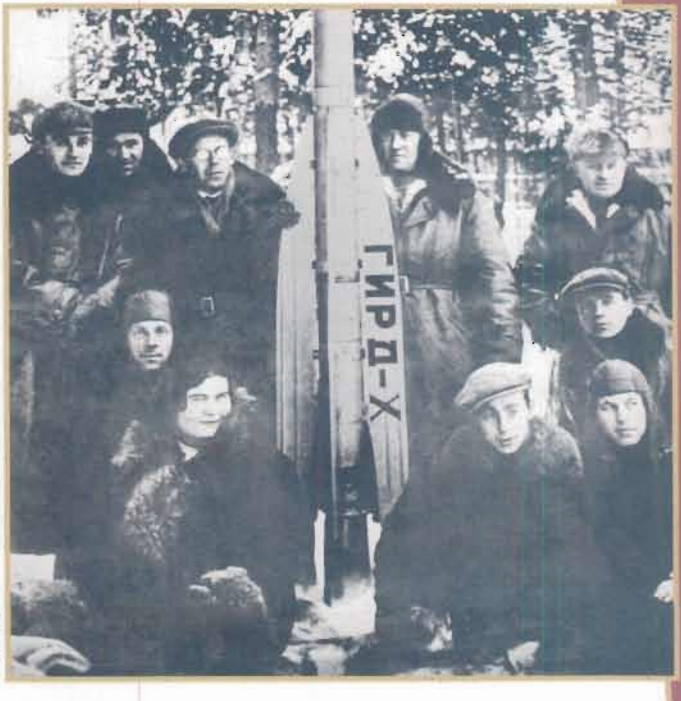
How did a man manage to contribute so much yet remain hidden? His shy nature and an aversion to taking credit all but ensured that his achievements in the Soviet space program would be often overlooked by history. His own office diary, which I was allowed to read, indicates that he was a workaholic, often forgoing vacation time to work. Much of the diary is cryptic or in code since everything he was doing was top secret; Tikhonravov may have been afraid to write too much down. But his words express a strong fealty to Korolev; almost every entry mentions him, and it is clear from the tone that Tikhonravov held Korolev in extremely high regard. One of the few times Tikhonravov shows any emotion in his diary is on the day of Korolev's death in 1966.

Tikhonravov had lived and worked for many years in the Moscow suburb of Yubileiny. For decades during the cold war, Yubileiny was a closed area. The town was so secret it did not appear on any maps and few Muscovites even knew it existed. It was the site of the most sensitive space organizations in the former Soviet Union. One of those was the 4th Scientific Research Institute of the Ministry of Defense, where Tikhonravov worked among grim military personnel devising strategies for the Soviet nuclear and space programs. There in the 1950s, he organized a group of young men and women—known as the Tikhonravov Group—who worked in secret on the R-7 rocket and Sputnik itself.

Few members of the group are alive today, but one of the brightest members still lives in Yubileiny. Oleg Viktorovich Gurko and his wife Larisa welcomed me last winter into their small, third floor apartment with a warmth that put me at ease. Gurko was wearing a cardigan and tie, giving him a look of formality. Their modest living room was cluttered with mementos from the Space Age: books, models, and souvenirs.

Our conversation soon turned to how Gurko first met Tikhonravov. World War II had just ended, and Gurko was eager to expand the space study group he had organized as a teenager, but he needed an outsider experienced in space science to guide it. Having heard of Tikhonravov's work, Gurko sought him out in hopes of persuading him to offer his support. Because Tikhonravov worked in a classified military institute, it was not easy to visit him, but Gurko was persistent.

Gurko still vividly remembers their first meeting. He and a friend were shown into an office with two military officers, one a stocky



Korolev (standing, far left) led the team of rocket enthusiasts and engineers that launched the first Soviet liquid-fueled rocket, called the 09, which Tikhonravov had designed. Tikhonravov missed the 1933 launch from a wooded suburb of Moscow, but the other enthusiasts watched it fly for about 18 seconds, reaching an altitude of about 1,300 feet.

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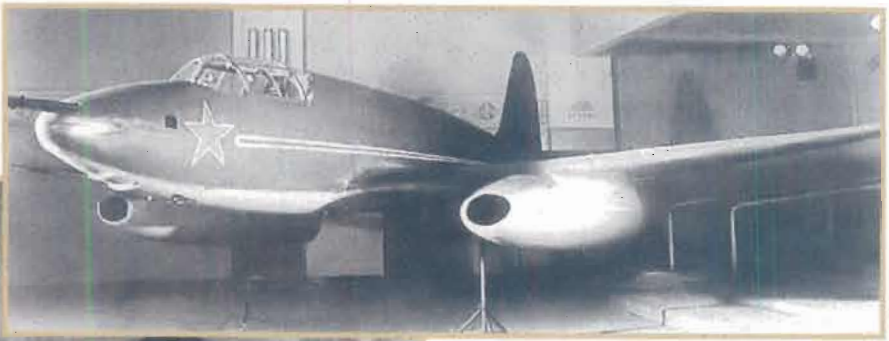
The 302P rocket-plane (right), which Tikhonravov designed in 1943, was never produced. Below, he greets Oleg Gurko (left) and Igor Yatsunsky during a 1966 reunion of the Tikhonravov Group.



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OLEG GURKO

man with an imposing presence, the other a shy, thin man of medium height with clear, lively eyes. Thinking that the heavier officer was Tikhonravov, Gurko turned to him and explained at length the work of the student group. Only after the meeting did Gurko discover that it was the other man—the one who had seemed unimportant—who was Tikhonravov.

TIKHONRAVOV WAS BORN in 1900 in Vladimir, one of the oldest cities in Russia, located a little more than 100 miles east of Moscow. His parents were teachers, and as a boy, he mastered Latin and ancient Greek. After finishing in the first class to graduate from the prestigious Zhukovsky Military Air Academy (his classmates included future airplane designers Sergei Ilyushin, Artem Mikoyan, and Alexander Yakovlev), he worked in the late 1920s as an aeronautical engineer. In his spare time, he studied gliders. At a 1927 regional glider competition, Tikhonravov met a 20-year-old aviation enthusiast named Sergei Korolev. In an apt metaphor for their later relationship, Tikhonravov designed a glider named *Firebird* that Korolev flew to gain his pilot license, thus bringing Korolev's name to prominence within the glider community. Besides holding a day job and working on gliders, Tikhonravov was a prolific writer. He wrote frequently on bird and insect flight. In the hope of replicating the flight of a bird, he spent years crunching numbers and doing experiments. Though he decided that human muscles, even augmented by wings, were simply incapable of flight, "Tikhonravov never gave up studying how birds fly," Gurko told me.

More than airplanes and other flying things, Tikhonravov's greatest passion was space exploration. He was an early convert to the cause, molded by the space and science fiction craze that raged in Russia in the 1920s (see "Russia's Long Love Affair With Space," June/July 2007). Tikhonravov believed that the first step to spaceflight would be to build a liquid-propellant rocket engine. In 1931, he heard through acquaintances that his old friend Korolev had joined up with another older enthusiast, Friedrich Tsander, in an attempt to mount a crude rocket engine on a glider. With a few others, they formed the Group for the Study of Reactive Motion (GIRD in its Russian acronym), a team with no official standing but a desire to do more than just talk about rockets.

Though GIRD existed for less than two years, its accomplishments were impressive. The late Russian space historian Yaroslav Golovanov characterized the team as an "apprenticeship" for Sputnik. By early 1933, the group had attracted the attention of the Soviet military but it had also had a number of setbacks, including the failure of an engine and Tsander's death from typhoid fever. Korolev, the leader of the group and the most practically inclined, desperately needed a success to show the military that the group was serious and to win government funding. Tikhonravov's experiments with a rocket known as 09 provided a glimpse of hope. A simple design that used a combination of liquid oxygen and jellied gasoline, the rocket weighed about 42 pounds. This was seat-of-the-pants rocketry: To launch the 09, the young engineers would put the rocket in the back of a rented truck and rush to their "launch base," a wooded area in the Nakhabino suburb of Moscow; they had to hurry so they could launch the rocket before the liquid oxygen in the fuel tanks evaporated.

Success came on August 17, 1933, when Tikhonravov's rocket reached about 1,300 feet. It was the first launch of a Soviet rocket that used liquid propellants, and came seven years after American Robert Goddard had accomplished the same feat in Auburn, Massachusetts. Ironically, Tikhonravov missed the big moment; before the launch, he had driven himself to such exhaustion that Korolev sent him off on a sailing and fishing trip on the Khoper River. A cryptic telegram from the team—"Examination passed"—was the only indication to Tikhonravov that the rocket had lifted off. Korolev, though, was careful to credit his friend with the actual design of the rocket. Years later, in the 1960s, an obelisk was erected in the same woods to mark this birthplace of Soviet rocketry. Tikhonravov always felt embarrassed that the monument was inscribed with only his name; according to Gurko, he felt the launch was a team effort.

GIRD's successes led to the formation of a rocket research institution in the early 1930s, sponsored by the Soviet government, yet the institute (known as RNII) was mired in infighting. When engineers clashed over technical options—particularly the selection of rocket propellants—they were unwilling to compromise, which created a poisonous atmosphere. Tikhonravov, who by then had moved on to less sensitive projects, largely avoided the disputes within RNII. Creative work was stalled, and the institute—as well as the rest of the country—then suffered Josef Stalin's purges. Many of those on the "wrong" side of a technical issue ended up in prison; some were shot. Tikhonravov's wife, Olga, told friends that her husband always kept a suitcase packed. Gurko refused to speculate why Tikhonravov was never included in Stalin's purges, but others I spoke with believe that he was saved by his natural shyness and avoidance of confrontation.

During World War II, Tikhonravov moved from project to project: He worked on the famous Katyusha rocket launchers, a rocket airplane, and even a manned high-altitude research rocket. He was on the first Soviet team to study the wreckage of the famous German V-2 rocket, a mission that completely changed the trajectory of Soviet rocket development. By the time he met Gurko, he was in his late 40s and a deputy director at the 4th Scientific Research Institute. The institute, a Soviet-style think tank much like the U.S. RAND Corporation, did not build rockets, but it generated ideas on how to use them in battle.

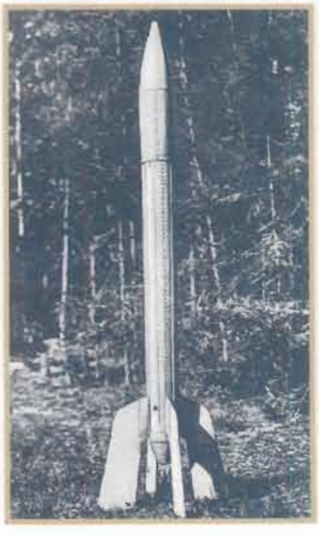
Tikhonravov recruited young engineers to design—on paper—a rocket that could fly across the world. He was well aware that such a rocket could also deliver a satellite to orbit. But the technical limitations seemed insurmountable: How to design a rocket engine that could fire at very high altitudes? In search of a solution, he decided to focus on an alternate path: Why not have all the engines fire on the ground at liftoff? He and his team developed an innovative design, a vehicle that clustered several single-stage rockets with engines that would fire simultaneously at launch. He called the new design a "packet."

Tikhonravov gave lectures on the idea at several high-level scientific conferences, culminating in a talk in 1950 in which he argued that with current Soviet technology, the country could launch a satellite using the cluster design. A few like-minded rocket scientists—including Korolev—were easily persuaded, but most were appalled that the institute had, as one critic fumed, "decided to switch to the realm of fantasy." So serious was the fallout that Tikhonravov was demoted and ordered not to meddle in spacecraft design.

He did not give up easily. With Korolev's quiet support, Tikhonravov regrouped his team of young engineers, adding fresh new university graduates, including the 24-year-old Gurko. The group was small, and most members were in their mid-20s. Together, between 1951 and 1953, the Tikhonravov Group worked intensively on a number of mathematical studies of the packet concept for an intercontinental ballistic missile. Besides Gurko, who worked on thermal equations, the brain trust included Igor Yatsunsky, who shared Tikhonravov's calm disposition and acted as his deputy; Anatoly Brykov, who studied how to connect missiles into a cluster; Grigory Moskalenko, who explored the mass characteristics of various rocket clusters; and Igor Bazhinov and Gleb Maksimov, who analyzed the motion of missiles through the upper atmosphere. The only woman in the group, Lidya Soldatova, worked with Brykov on making the strap-on booster rockets detach from the core booster.

The packet-design studies that these

Korolev (far left) watches as a rocket club member fills the 09 rocket's oxidizer tank. Fueled by liquid oxygen and jellied gasoline, the 09 (below) was launched more than seven years after Robert Goddard's first liquid-fueled rocket.



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young scientists produced profoundly influenced Korolev's thinking on an intercontinental ballistic missile. When Korolev's design bureau finally settled on an ICBM design, they chose Tikhonravov's cluster. The idea went through a number of major redesigns before the final version emerged as the R-7 rocket for Sputnik. In spirit, this majestic booster, whose descendants today launch cosmonauts to the International Space Station, owes its birth to Tikhonravov and his team.

There was more creative work to come. Tikhonravov obtained support to redirect his group of young scientists to start studying satellite design. In late 1953, at Tikhonravov's initiative, his bosses approved "Theme 72," the first serious study of satellites conducted in the Soviet Union, similar to the satellite studies RAND conducted at the time in the United States. The Tikhonravov Group explored a variety of engineering problems, with each member taking on a specific topic, such as placing a satellite in orbit, returning the launcher to Earth, and optically tracking the satellite.

Tikhonravov is buried in Moscow. Below: The designer with granddaughter Olechka and scientist Lidya Soldatova.

OLEG GURKO (2)

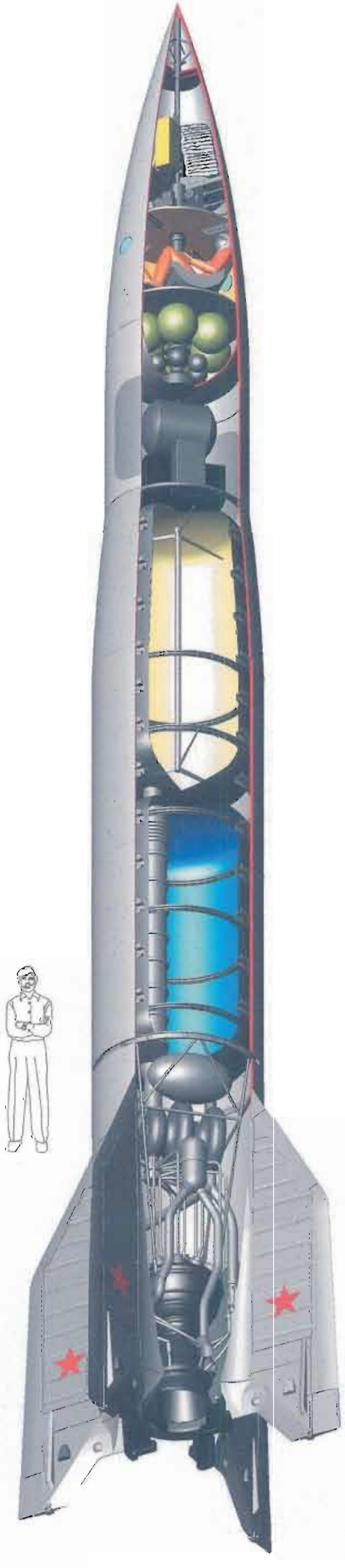
Tikhonravov's study was groundbreaking, but it would have languished had it not been for Korolev's enthusiasm for it. In May 1954, Korolev sent a letter to the Soviet government asking for approval to design and build a satellite. He attached a summary of Tikhonravov's work, which showed not only that a satellite could be built, but that the Soviets could beat the Americans into space. It took a year for the request to get through the Soviet bureaucracy and win approval. Tikhonravov's office diary provides a glimpse of the frustrations of this critical period. In one passage, he laments that after explaining satellites to an audience, "[t]here were no questions. Don't they get it? Or are they not interested?"

Armed with government approval, Korolev's engineers began building the first Soviet satellite, a nearly 3,000-pound observatory to study geophysical phenomena. The project proved to be overly ambitious. Korolev and Tikhonravov had to depend on a great number of subcontractors who rarely made their delivery deadlines. The two were also well aware of the United States' satellite project, Vanguard. In late 1956, both men were becoming worried that all of this complicated equipment would delay the primary goal: to get to space first. The historian Golovanov, who interviewed Tikhonravov, wrote about a crucial exchange between the two friends. Once, while Korolev was complaining about the delays, Tikhonravov suddenly piped up: "What if we make the satellite a little lighter and a little simpler? Thirty kilograms or so, even lighter." This single question, unassumingly raised, was the key to Soviet leadership in the Space Age.

In typical fashion, Korolev went into action, marshaled a handful of engineers, and ordered them to work on a "simple satellite." It would be a metal sphere (Korolev thought a sphere was the most elegant design) carrying a battery, a radio transmitter, a heat regulation system, some antennas, and not much else. There would be no subcontractors who could disappoint the program at a critical moment. Tikhonravov, who had by now transferred from the military institute to work directly under Korolev, oversaw the production of the 184-pound satellite.

In the weeks before launch, Tikhonravov spent days and nights next to the satellite, overseeing all the preparations. He took a break only to attend celebrations for the 100th birthday of Soviet space pioneer Konstantin Tsiolkovsky. The ceremonies were held in Moscow and in Tsiolkovsky's hometown, Kaluga, just two weeks before Sputnik's launch. A rare photo of Korolev and Tikhonravov in Kaluga shows both uncharacteristically smiling—they were on the cusp of their greatest achievement. Both men soon flew back to Tyuratam (later named the Baikonur Cosmodrome) to oversee work on the satellite. Remarkably, though Tikhonravov is acknowledged as the godfather of Sputnik, few remember him spending much time at the launch pad. Shy and unaccustomed to the hectic life at the launch range, he stayed out of the spotlight while Korolev directed all the preparations.

On the night of October 4, 1957, Tikhonravov's "simple satellite" took off in a burst



A. SHIYADINSKY AND I. AFANASYEV

The VR-190 (left), which Tikhonravov designed in 1946, was a two-seat suborbital spaceship. Its technologies ended up on the later Vostok and Soyuz spacecraft. Right: Gurko keeps a model of a spaceplane he proposed in the 1970s; the Buran was built instead.

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of thunder and flames and headed for the heavens, opening up the Space Age. Ecstatic and exhausted, Korolev and Tikhonravov were awake the whole night. The next day, Tikhonravov had only this to say in his diary: "Newspapers write about the Sputnik launch!"

After Sputnik, Tikhonravov directed all space projects under Korolev. Unlike his boss, who had become the monarch of the Soviet space program, Tikhonravov wielded little decision-making influence, although he guided the design of many spacecraft. Why was Tikhonravov in the shadows? Gurko believes that excessive modesty kept Tikhonravov from having a higher-profile career. "Tikhonravov was unusually intelligent, but he also avoided publicity," Gurko says. "He didn't care for awards or positions or influence."

Those who knew them say Korolev and Tikhonravov were completely different in character. Korolev was impulsive and had a volatile temper, and was feared by all. Tikhonravov, by contrast, always seemed approachable. Former cosmonaut Vitaly Sevastyanov, who worked under Tikhonravov, recalls that the man was "unhurried, thorough in his judgments, [and] capable of reflection. He never imposed his ideas on anyone else, and never raised his voice." Sevastyanov remembers that while Korolev would rage over the smallest trifle with others, with Tikhonravov he would always calm down.

Yet there was occasional friction between the two. For example, although he led the design team that created Yuri Gagarin's Vostok spacecraft, Tikhonravov was absent at Baikonur on April 12, 1961, when Gagarin was launched into orbit. Korolev hadn't bothered to invite him for the historic launch—a slight that, according to former Korolev deputy Boris Chertok, "very deeply upset" Tikhonravov.

Design work under Korolev may not have been easy but it was rewarding. Tikhonravov's last major contribution to the Soviet space program was designing the Luna probes, which in 1966 made the first soft landing on the moon.

By that time, Korolev was dead. Tikhonravov left the space business soon after, unable to get along with Korolev's successor, the irascible Vasily Mishin. Tikhonravov continued teaching at the Moscow Aviation Institute, but spent more time with Olga, whom he had met when both were young rocket enthusiasts in the amateur group GIRD and who shared his deep interest in space travel. In his spare time, he wrote and painted.

By the time Gurko last saw him in late 1973, Tikhonravov had cancer. He fell gravely ill soon after and died at the age of 73 on March 4, 1974. Olga died 19 years later. Their daughter, Nataliya, does not grant interviews. But others, like Gurko, are eager to promote Tikhonravov's legacy. In the history of the Soviet space program, "Tikhonravov's name should be right up there with that of Korolev!" Gurko said as I said goodbye.

Back in Moscow, I stopped by Novodevichy Cemetery, where some of Russia's most famous sons and daughters are buried. There, an imposing bust of Tikhonravov stands over his grave. An inscription describes him simply as the designer of the "first Soviet rocket." There is no mention of Sputnik, the R-7, Vostok, or Luna. In death as in life, Tikhonravov remains a modest figure, overshadowed by others who were more charismatic.

How Things Work: Evacuation

BY MARK HUBER | ILLUSTRATIONS BY JOHN MACNEILL

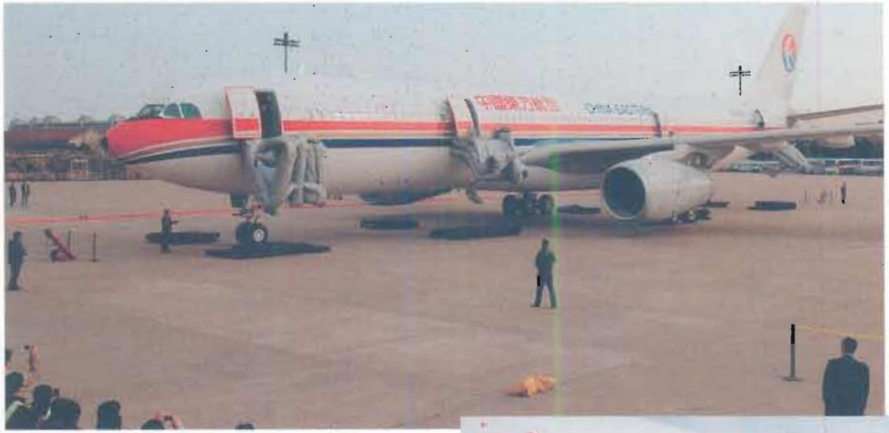
THE POST-CRASH FIRE THAT CONSUMED AIR FRANCE FLIGHT 358, AN AIRBUS A340 THAT OVERRAN A TORONTO RUNWAY IN 2005, COULD HAVE BEEN A KILLER, BUT ALL 309 ABOARD ESCAPED WITH NO LIFE-THREATENING INJURIES. BY THE TIME EMERGENCY RESPONSE TEAMS HAD ARRIVED, 52 SECONDS AFTER THE AIRLINER BURST INTO FLAMES, MOST OF THE PASSENGERS HAD ALREADY EXITED ON EVACUATION SLIDES.

The Airbus met almost to the letter the Federal Aviation Administration requirement that an airliner be capable of being evacuated within 90 seconds in the dark and with half the exits blocked—"almost" to the letter because the crash occurred not in the dark but on an August afternoon. But the evacuation was successful even though several exits were compromised by the fire and jagged metal and one slide was inoperable, apparently jarred loose when the airliner plunged into a ravine.

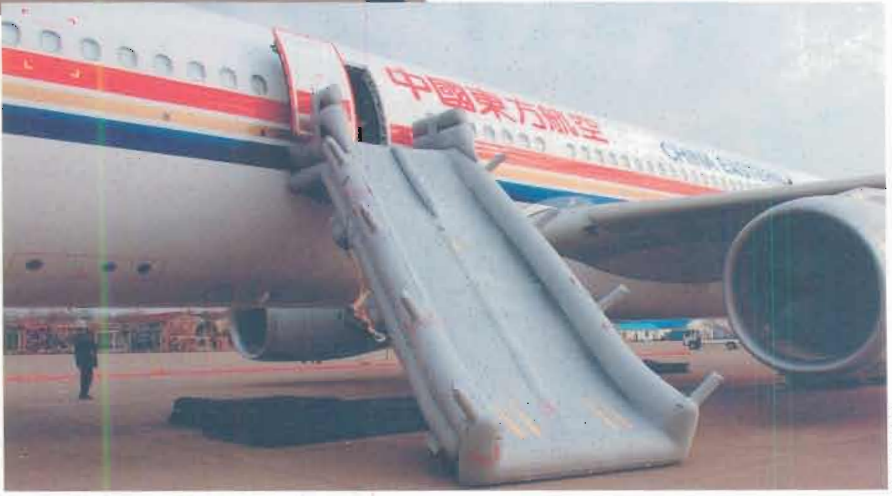
Designing evacuation slides has grown more complex as the FAA has tightened performance standards. In the early 1960s, slides had to deploy in 25 seconds in non-extreme weather: no wind and medium-range temperatures. Today's slides must deploy in six seconds in temperatures ranging from –65 to 160 degrees Fahrenheit and unfurl in winds up to 25 knots (28.7 mph). Airlines impose further challenges: Slides must be light and compact enough to fit inside an aircraft door or below the door sill or emergency exit window. So each slide is uniquely developed for its location on an aircraft model.

An escape slide sits inside a carbon fiber pressure cap covered by a casing of material similar to the aircraft interior walls—that big square box at the bottom of an airliner's interior door. Pushing a lever on the interior door—a large silver bar on early airliner models, smaller handles on later ones—arms the slide mechanism by linking the slide to the door sill. When the lever is in the "armed" position, opening the door pulls the slide out of its pack. The slide then drops to the correct orientation for inflation to begin. (When flight attendants issue the call to "cross-check" after landing, that is a signal for one attendant to check another's action to disarm the doors to prevent slides from inadvertently deploying.)

Slides inflate with an initial boost from



From the door and emergency exits of a China Eastern Airlines Airbus A330-300, evacuation slides begin to unfurl (left) and deploy (below). The fully inflated slide is 31 feet long.



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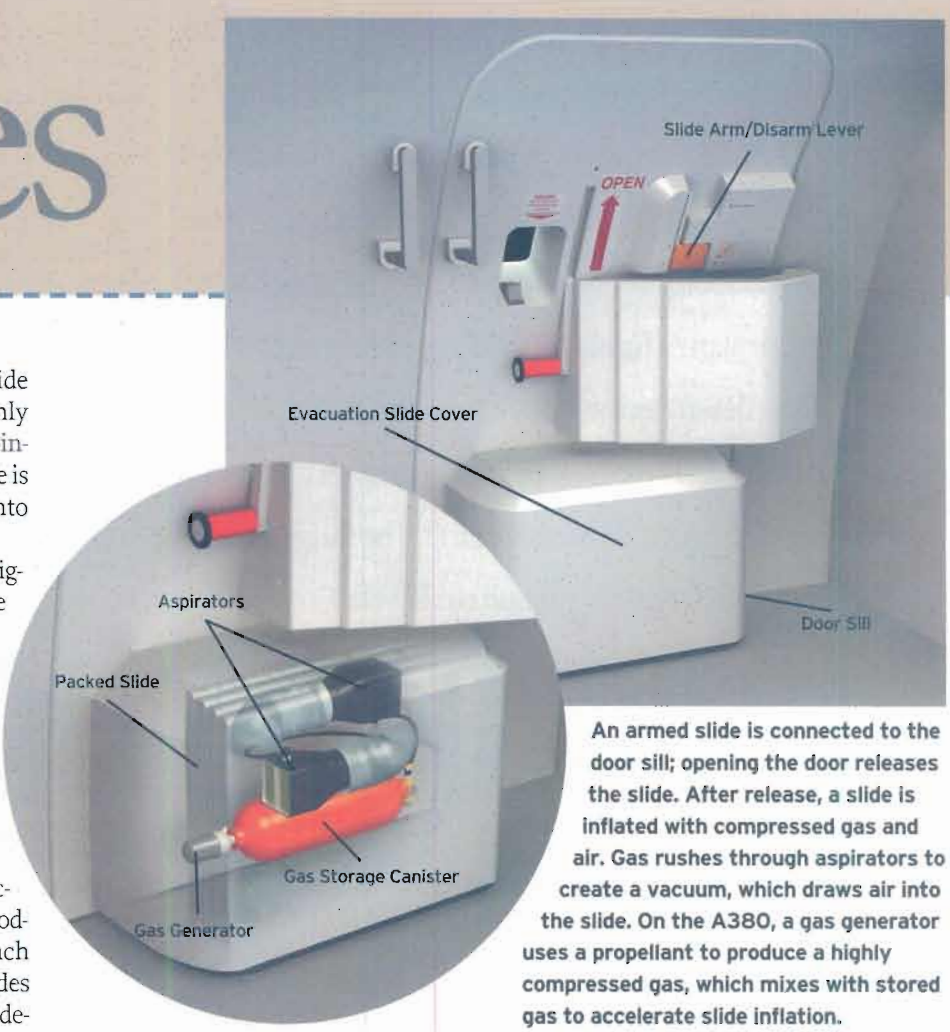
Slides



An armed slide is connected to the door sill; opening the door releases the slide. After release, a slide is inflated with compressed gas and air. Gas rushes through aspirators to create a vacuum, which draws air into the slide. On the A380, a gas generator uses a propellant to produce a highly compressed gas, which mixes with stored gas to accelerate slide inflation.

a canister of compressed carbon dioxide and nitrogen. The canister provides only about one-third the volume needed to inflate the slides. The remaining volume is supplied by ambient air, channeled into the slides through aspirators.

When the inflation mechanism is triggered—by a lanyard pulled by the slide as it tumbles from its storage case—gas from the canister accelerates through the aspirators at high speed, creating a vacuum that sucks ambient air into the aspirators through louvers. When the slide is fully inflated, the louvers close.

At its Phoenix, Arizona plant, Goodrich manufactures airliner evacuation slides for a number of airliner models, including the 16 slides aboard each giant Airbus A380. To get the A380 slides fully inflated in six seconds, Goodrich developed an inflator that uses a gas generator about the size of a soda can that contributes more inflation gas volume to the slides without adding too much bulk and weight to the slide package. When a propellant in the generator is ignited, it produces a highly compressed gas almost instantly. This gas mixes with stored gas in the canister to accelerate slide inflation.

Slides are made of urethane-coated nylon that is sprayed with gray aluminized paint, which protects the slide in case of a nearby fire by reflecting heat for at least the 90 seconds of the slide's use. To save pack weight and decrease inflation time for the A380 and new-generation aircraft to follow, Goodrich adopted a stronger fiber for the inflation tube fabric. Increasing the strength and tear resistance of the fabric enables slide inflation tubes to be designed with a smaller diameter.

The inflated slide must flex precisely under a variety of weights to enable passengers to slide down quickly but not so fast that they are injured when they reach the bottom. In order to ensure that 800 passengers could exit an A380 in 90 seconds, its dual-lane slides are qualified to transport 70 passengers in one minute.

Developing modern slides is "like trying to balance a sheet of plywood on the head of a pin by throwing nickels at it from 50 yards away," says Mark Robertson, a Goodrich vice president for engineering and quality, describing the amount of old-fashioned trial and error necessary. At its Phoenix plant, Goodrich uses an environmental chamber, six giant wind machines, elevated aircraft test fixtures including actual aircraft doors, and darkened tunnels connected to the doors for test jumps onto slides in simulated rain and nighttime conditions. For a standard dual-lane slide, test subjects make as many as 50 test runs at various pressures and door sill heights.

According to Goodrich, the reason passengers sustain injuries during evacuation is that they ignore instructions and hesitate or stop at the end of the slide, making them collide with other evacuees coming down, or instead of sitting upright, they lie down and descend too fast. Targets on the slide and built-in light-emitting diode (LED) lights give evacuating passengers aim points for jumping on and off.

Because slides must often function as life rafts for as many as 87 people, Goodrich conducts trials off the coast of Santa Barbara, California, where ocean conditions closely approximate those set forth in FAA regulations for exit slide performance.

With proper maintenance, a slide will last 15 years. Every three years a slide is deployed, removed, inspected, re-tested, re-packed, and re-installed. The inspection cycle is a way to make sure that slides will perform as they did last August, when a China Airlines 737 arriving in Okinawa experienced an engine explosion, and all 165 aboard escaped safely on inflatable slides just before the plane burst into flames.

PAUL MANTZ DIED IN FOCUS. At 24 frames per second, in Color by DeLuxe, hitting his mark for the cameras in a hurtling aircraft as he had for 35 years. A grisly outtake, faded after decades in the Twentieth Century Fox film vault, records the catastrophe that took place on the set of *The Flight of the Phoenix* in 1965: The airplane's fuselage buckling, its forward section diving into the desert floor and disintegrating at 90 mph. Rescuers rush into the frame and a cloud of dust settles on the crash site as the camera continues to roll. The king of Hollywood pilots was dead before anyone could yell "Cut."

BY STEPHEN JOINER

"I always thought two things about Paul," says James Morrison, an assistant film director who worked with Mantz during the 1950s. "He had it figured that he had a 95 percent chance of coming out alive in every shot he made. And he knew very well that one day he was going to hit that five percent."

The shots he made are among commercial cinema's most memorable flight footage. That's Mantz belly-landing a Boeing B-17 in the 1949 film *Twelve O'Clock High.* (His $4,500 paycheck made it at the time the highest-paying movie stunt in history.) All told, Mantz performed stunts in more than 40 films, including *For Whom the Bell Tolls, Around the World in Eighty Days,* and *It's a Mad Mad Mad Mad World.*

His work in front of the camera and behind it—eventually he went from performing aerial maneuvers himself to piloting the camera airplane—transformed the pilot's role in movies and raised aerial cinematography to an art. "He was the first pilot to get a Director's Guild card so he could sit down with them as an equal," says motion picture pilot Corkey Fornof, who has performed aerial stunts in such films as *Mission: Impossible II* and *License to Kill.* "Before Paul, directors would call a stunt flier and say, 'Here's a biplane—take it up and do some rolls.' Beginning with him, and right up to my own work today, pilots have creative input, and we're involved with lighting and background and editing the film to get as much out of the shot as we can."

ACADEMY OF MOTION PICTURE ARTS AND SCIENCES

Mantz took flying lessons at age 16. Eight years later, he forged a transcript from Stanford University to gain admittance to the U.S. Army Aviation Cadet Corps. "It's hard now to imagine him ever fitting into a military career," his grandson says today. An airport architect and keeper of the Mantz archives, Gregory Mantz has extensively researched his grandfather's life and work and developed a screenplay based on it. Mantz chafed at the strictures of military flying, he says, and demonstrated poor impulse control at least once: A day and one solo hour short of graduation, he buzzed a railroad depot near Palm Springs and played chicken with an oncoming train, clearing the smokestack by inches and traumatizing its passengers. Upon landing, he was arrested by military police and booted out of the corps.

Having turned to civil aviation, Mantz was restlessly running a fixed-base operation and flight school in Palo Alto, California, while making occasional charter flights to the airport in Burbank. There the hangars and skies swarmed with activity connected to the movie studios nearby. Mantz was drawn to the buzz—the star factor, the beautiful women, the apparently easy money. "Paul Mantz was a player," says Greg Mantz. "On that first trip to Hollywood, he took a look around and developed the firm intention to become a celebrity himself someday."

But the dream factory was a closed shop, with aerial filming dominated by the insular Associated Motion Picture Pilots. Frank Clarke, the union's alpha pilot, flew the big-money scenes paired with Elmer Dyer, the dean of Hollywood cinematographers, who would fly with no one else. Clarke was also a turf-protector, inhospitable to fresh faces from Anytown. Since Mantz saw little hope of getting his big break in the sky without a union card, he went back to Palo Alto to hatch Plan B.

Fornof, who was introduced to Mantz by his father, a dealer of salvaged World War II aircraft, is familiar with the obstacles Mantz faced. "For an unknown flier, breaking into movies was very difficult back then, and it's still pretty tough today," he says. "First, you've got to make a name for yourself somehow." To grab Hollywood's attention, Mantz

The greatest stunt pilot in movie history, Paul Mantz (opposite) also made his mark behind the scenes by flying camera airplanes (left).

INSET: ALLAN GRANT/TIME-LIFE PICTURES/GETTY IMAGES

Hollywood's Favorite Pilot

PAUL MANTZ WAS ALWAYS GOOD FOR ONE MORE TAKE.

needed a career move. He chose the outside loop, a 360-degree maneuver with the aircraft inverted at the bottom of the circle.

"Every barnstormer was flying inside loops, but even one outside loop in the aircraft of that day was a big deal," says Fornof. The continuous state of negative Gs fuel-starves carbureted engines. An outside loop punishes pilots too, he says, "because it's trying to throw you out of the cockpit every second. The blood pools in your head, swelling the blood vessels, and your eyes become terribly bloodshot." In July 1930, Mantz dismantled the carburetor on a Fleet biplane and reinstalled a modified version to resist the effects of negative Gs. He put the Fleet through an astonishing 46 consecutive outside loops. "The news was a tremendous flash in aviation at the time," says Fornof. "Paul was considered almost an aerobatic genius."

Still, Frank Clarke remained wary of the overnight sensation. Once, when Mantz appeared at an AMPP meeting with his $10 initiation dues in hand, Clarke hurriedly made a motion to raise the membership fee to $100. The "ayes" were unanimous.

An opportunity finally opened up on a film called *The Galloping Ghost*, an assignment nobody else wanted because it was too hazardous. Mantz delivered in a single take, walked away in one piece, and soon had a union card in his pocket.

Clarke's fears about ambitious newcomers were swiftly realized as Mantz began cheerfully dismantling the status quo that had favored Clarke and other union pilots. Knowing that directors and producers were deeply dissatisfied with the Associated Motion Picture Pilots, Mantz opened United Air Services at Burbank airport to offer studios a one-stop alternative with pilots, aircraft, and a money-back guarantee of cinematographic results. "Think of it as a Hollywood Air Force," he liked to say. Mantz siphoned off the elite from the AMPP's pilots, filling his hangar with a lucrative labor pool. "Even Frank Clarke ended up working for Paul," says Greg Mantz. "Eventually, everybody did."

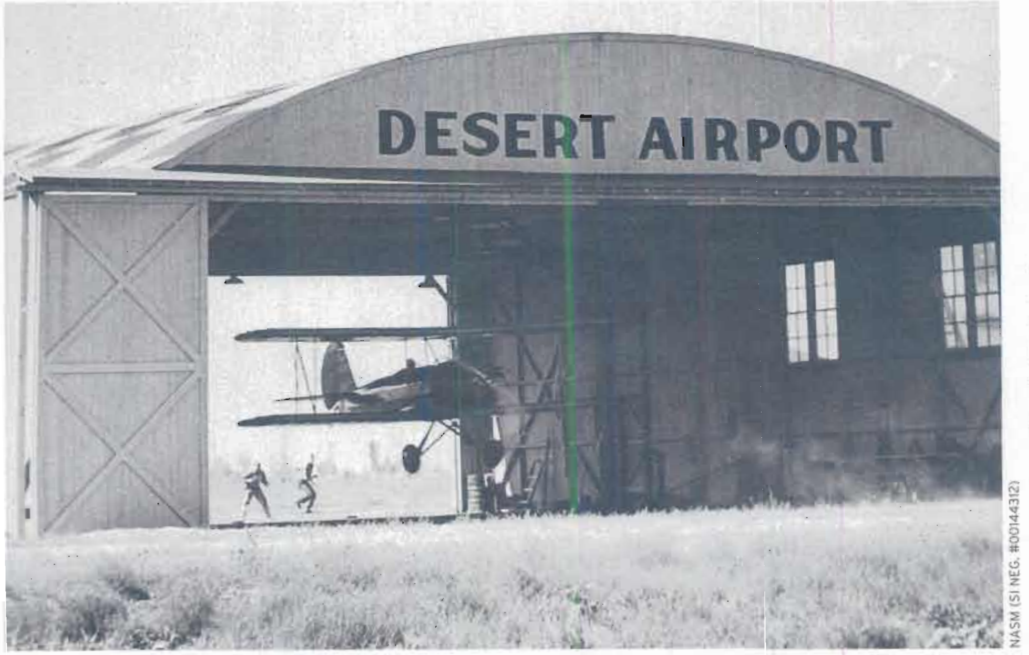
"Everybody" included Clarke's cameraman, Elmer Dyer. His first project with Mantz, for the 1932 film *Air Mail*, was a first for the American cinema as well: an airplane flying througth a hangar with less than five feet of clearance off each wingtip. Mantz carefully plotted the stunt in advance and performed it flawlessly. Recalling the feat in a magazine article he wrote for *American Cinematographer* in 1965, Dyer wrote, "I knew I had just filmed a page in aviation history." Over the next 25 years, Mantz partnered with Dyer on countless movies, from shorts to features, using profits to advance the technology: gyroscopic camera mounts and heated canopies for his cameramen. "He did everything possible to help me get good pictures," Dyer wrote.

On the ground, Mantz was living the good life. "He made a lot of money fast and drank martinis with the biggest stars," says his grandson. Like any self-promoting screen sensation, Mantz engaged a clipping service to preserve every mention of his name in print. Even in the cockpit, he dressed like a leading man, in custom-made suits with silk ties and diamond watches. In an era when the romance and daring of aviation rivaled the glamour of the silver screen, however, he was never starstruck around the Hollywood luminaries he mixed with. "It was the other way around," says Fornof.

Though Mantz continued to work in front of the camera, he also took on a larger role in movie-making by piloting the camera airplane. His favorite camera ship for shooting black-and-white movies was the Boe-

NASM (SI NEG. #A-38749-G)

Mantz' three-year friendship with Amelia Earhart (at left) led to the breakup of his first marriage.



NASM (SI NEG. #00144312)

The 1932 film *Air Mail*, starring Ralph Bellamy and Gloria Stuart, required Mantz to pull off a spectacular stunt: threading a biplane through a hangar.

ing P-12, fast and aerobatic so it could keep up with the action. With the advent of color film, however, Mantz employed Stearmans and Travel Airs to handle the heavier Technicolor cameras, which weighed more than 350 pounds. He integrated the disciplines of flying and filming with a philosophy of meticulous planning and execution. Unlike Frank Clarke, who flew by the seat of his pants, "Paul strongly believed it was possible to make a science out of flying for the movies," says his grandson.

"I'm not a stunt pilot," Mantz always insisted. "I'm a precision pilot." Each aerial scene was choreographed on storyboards, with altitudes and position plotted on a timeline. "Before they took off, he knew where the sun would be in every phase of the shot," says Greg Mantz. "He had mapped out exactly where the camera plane and the subject had to stay in relation to each other to get the best angles."

By the late 1930s, United Air Services virtually monopolized aerial filming. To cover the intermittent downtime in making motion pictures, Mantz diversified into such areas as air ambulance work and flight instruction. He also capitalized on his famous connections by starting a charter service nicknamed the Honeymoon Express: Celebrity couples were overnighted to Las Vegas for instant weddings. Mantz flew others (or the same ones, later) to Yuma, Arizona, for quickie divorces.

Mantz had first-hand experience with marriages souring. He had married Myrtle Harvey in 1932 (she had been one of his flying students), but only three years later she filed for divorce. The name listed as a co-respondent in her lawsuit was none other than Amelia Earhart. "Paul was infatuated with her," says Fornof. In fact, the closeness of their collaboration provided grist for gossip columns, though no one ever proved the relationship went beyond platonic. In 1934, Earhart hired Mantz as a $100-a-day technical advisor for her planned flight around the world. The job description soon expanded to nurse-maiding the marginally proficient Earhart in the cockpit, while butting heads with her manager-husband, publisher George Putnam, who vetoed many of Mantz' suggestions. By 1937, Mantz had suspended all movie flying and was devoting himself full-time to tutoring Earhart. She in turn invested in United Air Services, and together they brainstormed an Earhart-Mantz Flying School and a traveling air circus. But after Earhart ground-looped her Lockheed Electra in Honolulu on her first attempt to circle the globe, Mantz was quietly dropped from the project. He was not notified when she took off from Miami on her second attempt, flying the west-to-east route he had advised against.

"Until the day he died, my grandfather insisted that Amelia was not a good pilot," says Greg Mantz. "She wasn't qualified for that flight. When he left the team, he knew he was going to watch her kill herself."

IN 1946, MANTZ STOOD AMID ACRES of aerodynamic aluminum at a War Assets Administration aircraft storage lot in Stillwater, Oklahoma. Certain that a postwar boom in motion picture production, particularly war movies, was imminent, he had come to purchase 475 surplus bombers and fighters for $55,000—probably less than the total value of the fuel left in their tanks. He flew a dozen of the more cherry airplanes back to Burbank, drained the fuel from the others, and scrapped the aluminum for an enormous profit. Among the pound rescues were three that would loom large in his career.

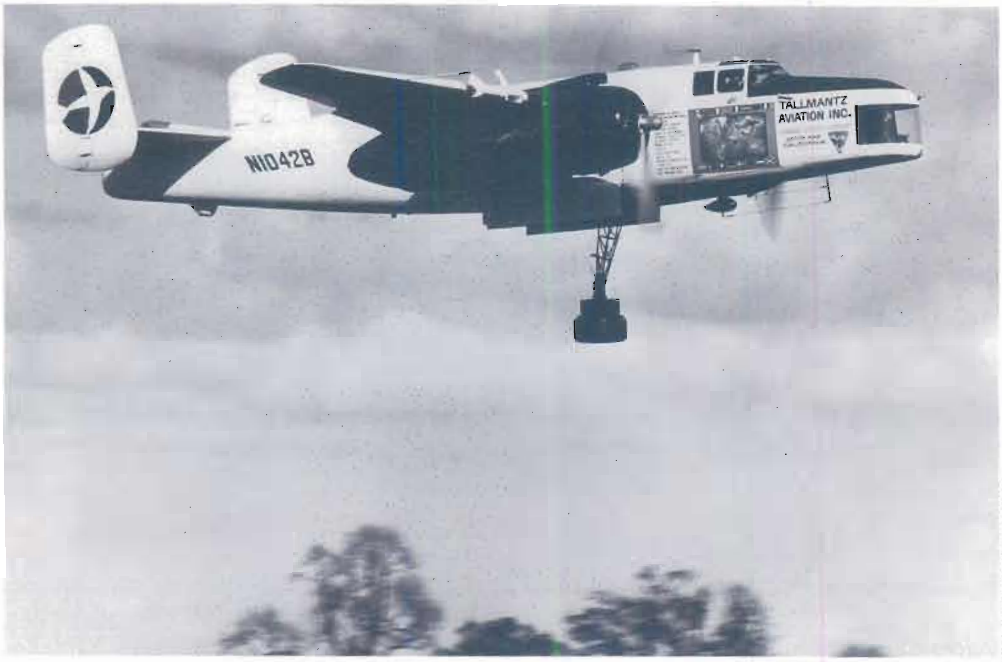
A charter service operating out of Burbank ferried Mantz' famous friends, including Bob Hope (second from bottom; Mantz is behind Hope), to destinations in Nevada and Arizona.

DON DWIGGINS COLLECTION

Flying in his Lockheed Orion, Mantz had never placed better than third in the Bendix Trophy races of the 1930s, a lingering frustration, despite his Hollywood successes. As a result of his buying spree, however, he now owned two examples of the hottest production airplane on the planet: the thundering, 12-cylinder P-51 Mustang. To gain an edge over his competitors, Mantz sealed all openings in the fighters' wing cavities and filled the spaces with fuel, eliminating the need for speed-sapping drop tanks. In his blood-red P-51s (registered as NX1202 and NX1204), he made history by winning the Bendix an unprecedented three years in a row: 1946, 1947, and 1948. Mantz so prized the trophy that he initially balked at returning it to the Bendix committee so that it could be awarded to the 1949 winner.

Another of Mantz' surplus acquisitions was a B-25 he named *The Smasher*. It would become his preferred camera platform, in continual demand by the studios. "Paul liked B-25s because he could put a cameraman in the nose, another one in the tail, and he could hang cameras out of the bomb bay too," says Fornof. Mantz upgraded *The Smasher* by replacing the standard Plexiglas nose turret with an optically perfect wraparound camera window, ground in Germany at enormous cost. And to gain 360 degrees of camera angles, Mantz engineered a circular, 11-camera platform that deployed from the bomb bay. Other modifications were lower-tech. "Until you get above 150 feet, you're in the zone of flying insects," says Greg Mantz. "They would splatter all over that big camera window in the nose [hence the name *The Smasher*]. Paul rigged up a system to cover the window with butcher paper until they exceeded bug altitude, then peel the paper away."

"Mantz and his B-25 saved Cinerama," assistant director James Morrison says today. The development of Cinerama was hailed as a savior of the movie industry, which in the early 1950s was experiencing a box office slump some blamed on the advent of



COURTESY STEPHEN JOINER

NASM (SI NEG. #7B04340)

Mantz advertised his aerial production companies as one-stop shops where studio executives could hire experienced motion picture pilots and rent a variety of aircraft, including a Bell 47B helicopter (left). Most in demand, though, was a North American B-25, which Mantz had modified into a superb camera platform (above).

television. Made up of three 35-mm cameras that shared a single rotating shutter, a Cinerama camera produced a widescreen image that filled nearly the entire field of vision. But to convey drama, the format needed sweeping panoramas, and efforts to produce the first feature, *This Is Cinerama*, were stymied by lack of suitable footage.

"We barely had enough material for half a picture when somebody had the idea to hire Paul to fly across the country and film America from a low altitude," says Morrison. "That's really what rescued us."

With the massive Cinerama camera mounted in *The Smasher*'s nose, Mantz gave audiences a cinematic thrill ride over the American landscape, plunging between the narrow walls of Zion Canyon in Utah, swooping under the Golden Gate Bridge, and buzzing the Statue of Liberty. Premiering in September 1952, the film was a hit, and it created a monopoly for Mantz. Throughout the 1950s and early '60s he flew Cinerama shoots around the world in *The Smasher*, now outfitted with amenities including sleeping cots and a well-stocked bar, which never closed.

"Paul introduced me to the virtues of vodka martinis," says Morrison, who flew during the filming of *Seven Wonders of the World* in 1955. As the *Seven Wonders* crew enjoyed an alcohol-filled dinner on location in Africa one night, the restaurateur recommended a scenic volcano 250 miles to the north. "We were all drunk, and Paul says, 'That sounds like a hell of an idea!' " recalls Morrison. After a hungover flight at dawn, the active volcano rose before them. "The crater was about the size of Shea Stadium," says Morrison. "Fire and clouds of sulfur were pouring out. Mantz yells, 'Start shooting!' and put that plane into a steep bank, circling down below the rim of the volcano, doing more than 150 miles per hour." Though the aesthetics of cameraman Gayne Rescher's footage soared as he captured the lower regions of the caldera, the oxygen content of the sulfuric cloud decreased with depth. "The engines started coughing, starving for air, and we were losing power right above all that fire and lava," says Morrison. "Paul hit the throttle and got us up over the rim and into good air just in time. We sent the film back to New York, and, man, they just went wild."

By the early 1960s, Mantz was spending more time at home with his second wife, Terry, with whom he'd had a son, also named Paul, in 1938 (Mantz also adopted Terry's two children, Roy and Terita; Greg Mantz is the son of Roy). Mantz and Terry lived on Balboa Island off Newport Beach, California, where Mantz plied local harbors as a gentleman yachtsman. His career had made him more than $10 million. Now he was gradually separating from things Hollywood. Photographs taken during this time show his expensive suits and flamboyant jewelry replaced by Hawaiian shirts and Bermuda shorts. He became the partner of a younger pilot, Frank Tallman, and called their new merged company Tallmantz Aviation. Most of his Hollywood Air Force had been retired to the Movieland of the Air museum, which he founded at Orange County Airport in southern California (the museum closed in 1985). "I'm 61," Mantz told the *Long Beach Press-Telegram* in early 1965. "I'm trying to wean myself away from this stuff."

But there was always one more take.

LEFT: LOOMIS DEAN/TIME-LIFE PICTURES/GETTY IMAGES; RIGHT: NASM (SI NEG. #HGC-1108)

Beginning in 1946, Mantz won the Bendix air racing trophy three years in a row. For his first two wins, he flew *Blaze of Noon* (above). Mantz' modifications to the P-51 enabled him to beat a field of competitors that included record-setter Jackie Cochran.

When Tallman broke his leg and couldn't fly a stunt for *The Flight of the Phoenix*, starring Mantz' friend James Stewart, Mantz stepped in. The plot involved a rickety transport forced down in the Sahara desert. The crew fashions the remains of the wrecked transport into an airplane they name *Phoenix*. Tallmantz Aviation contracted with veteran builder Otto Timm to construct a crude, precarious craft, to be flown only for the film. Test flights of the *Phoenix* in June 1965 revealed controllability problems caused by nose-heaviness. Though Mantz wasn't happy with the way the aircraft had been built, he was unfazed by the complications. "I'm hired to lick the technical problems," he remarked. Finally, on July 7, at the desert filming location along the California-Arizona border, he finessed the *Phoenix* over the dunes with stuntman Bobby Rose crouching behind him in the cockpit.

With just one flight scene remaining, shooting resumed early on the morning of July 8. As usual, Mantz expertly put the shot in the can. All three cameras reported good takes, but, while Mantz and Rose were still aloft, the director called for one more.

It's a formality known as an "insurance shot," a safeguard against gaffes. Directors had been asking Mantz for them for 35 years. "I'll give them a good one," he radioed, and banked the *Phoenix* back into the lenses.

This time his rate of descent was noticeably higher. Instead of skimming the surface, the ungainly aircraft smacked the sun-baked desert and rebounded into the air. It impacted a second time with a sickening crack, the fuselage splitting just behind the cockpit. The *Phoenix*'s nose pitched forward, and the Pratt & Whitney engine excavated a storm of sand. The wings and rear fuselage tumbled across the viewfinders of the cameras, mangling the separated cockpit beneath. Rose was thrown clear and injured. Mantz died instantly.

Though the Civil Aeronautics Board noted the airframe failure of the *Phoenix*, the agency's accident report also mentioned the pilot's "alcoholic impairment of efficiency and judgment." Mantz' blood alcohol tested above the Federal Aviation Administration limit, though it might well have been similarly high after any of the dozens of stunts he had safely executed. "The fact is, he was drinking all those years," says Greg Mantz. "In the circles he traveled in, there was an awful lot of that." It's unclear what role alcohol played in the crash.

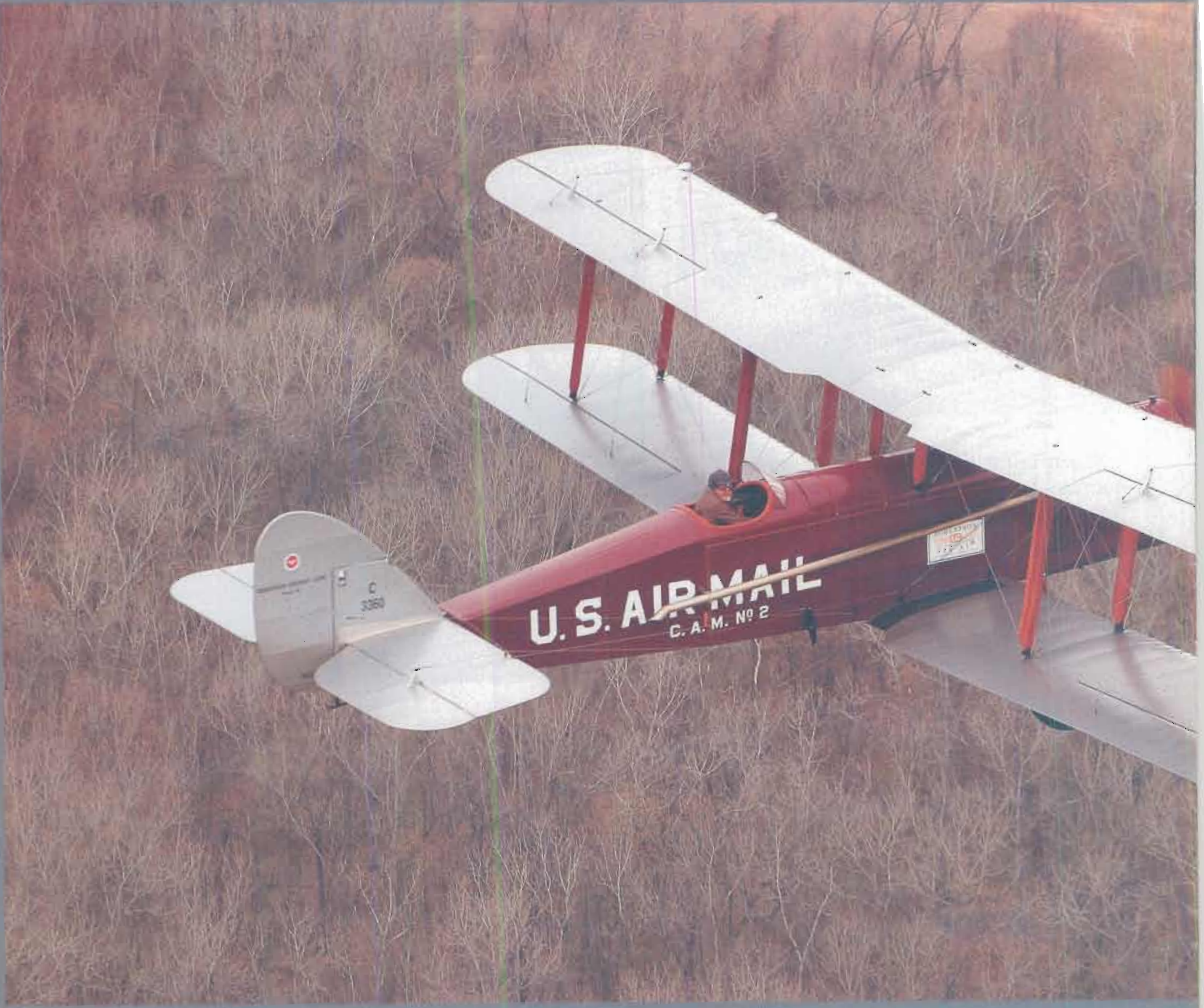
Mantz' body was flown back to Orange County in *The Smasher*. At Forest Lawn, his funeral mingled Hollywood royalty with aviation legends. Among the pallbearers were Jimmy Doolittle, John Ford, James Stewart, and Chuck Yeager.

Five months later, *The Flight of the Phoenix* premiered just in time for the Christmas box office. In the scene immediately following the last good take of Mantz' life, an intact *Phoenix* soars triumphantly into the sky. It was a lookalike airplane, filmed days after his death.

After the closing credits, a tribute scrolled into view: "It should be remembered that Paul Mantz, a fine man and a brilliant flyer, gave his life in the making of this film." ✈

Sightings

PICTURES WORTH A SECOND LOOK



FOR EVERYTHING THERE IS A SEASON. When it comes to taking aerial photos of vintage aircraft, they are all good.

A de Havilland D.H.4 (above) streaks over a bare winter woodlands near St Louis, Missouri. Following World War I, the combat airplane was brought to the United States from England and modified to carry mail. A springtime field of flowers serves as a backdrop for a Waco Taperwing T-10 (opposite, top) flying in eastern Wisconsin. The Troy, Ohio builder was the leading U.S. manufacturer of civilian aircraft in the early 1930s.

The lure of amphibious aircraft is strongest in summer—and with a Grumman Widgeon (center) at your disposal to explore Florida's Gulf of Mexico coast, the beach is just a drop in altitude away. If your ride is a Howard DGA-15, you can appreciate the fall splendor of the Mississippi River Valley near Red Wing, Minnesota, in style, the way Howard pilots have since the aircraft was unveiled in 1940.

DON PARSONS

JIM KOEPNICK (2)

MAX HAYNES

Pre-Flight and After Hours

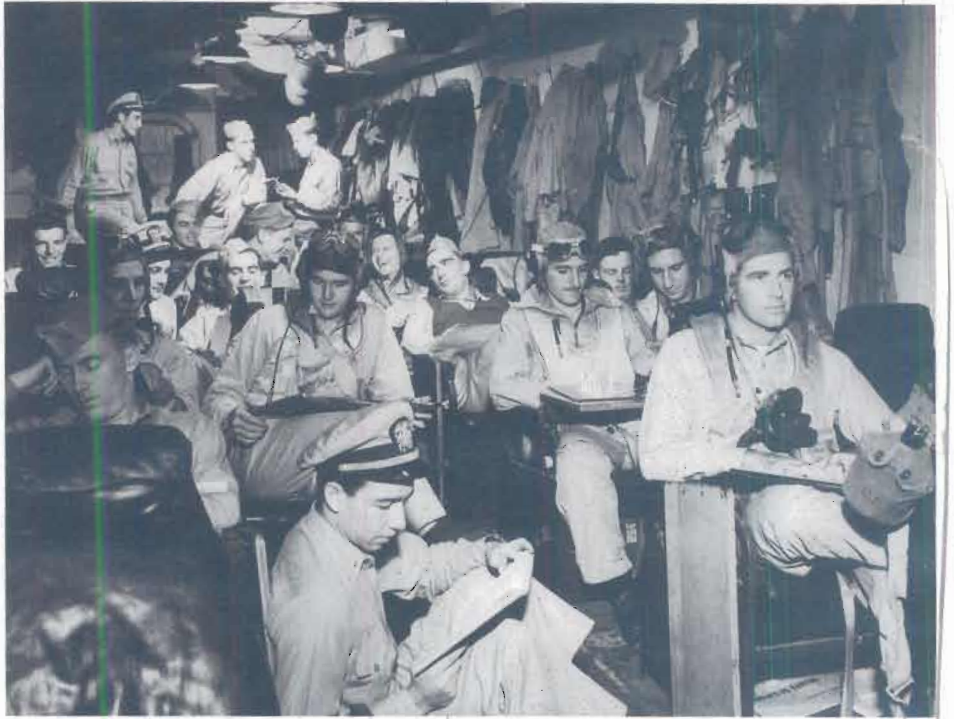
LIKE A LOCKER ROOM where a sports team suits up and plans for victory, the ready room aboard an aircraft carrier is the place where Navy (and sometimes Marine) aviators prepare to execute their missions.

During World War II, ready rooms were located on the gallery deck, just below the flight deck. But bombs and kamikaze attacks forced the Navy to put the room deeper in the ship, and wartime pilots would have to lug their heavy gear up as many as five decks to reach their airplanes (elevators weren't added until the 1950s). In today's carriers the decks are hardened, so the ready room has returned to the gallery deck.

"Our ready room serves the same purpose as 50 years ago: a gathering place for professional flight briefings, and work space for all other occasions," says Navy Commander Clark "Ollie" Troyer, executive officer of Strike Fighter Squadron 154 of Carrier Air Wing 9 aboard the *John C. Stennis*, a Nimitz-class carrier currently deployed to the Indian Ocean. The pencils, papers, and maps that pilots once used to plot their routes have been replaced by computers. Troyer says that after a briefing, flight crews go to a nearby loft, where the parachute riggers work, to don their flightsuits. Then pilots "get our gear together, catch our breath, walk up on deck, and start engines a half-hour before flight," he says. "After the mission, we reverse the process. Get undressed in the loft, go to the ready room for a de-brief and also de-brief the aircraft maintainers. We'll do some paperwork in the computer, record the mission we flew. Then we de-brief for anywhere from15 minutes to two hours.

US NAVY/PHOTOGRAPHER'S MATE 2ND CLASS FELIX GARZA JR.

"There definitely is social time as well," Troyer says. "In the evening after the last flight, the squadron duty officer will do a 'roll 'em'—our movie for the night. He'll dig out a movie or CD and that's our time for pilots to stand down or read magazines."



In World War II, carrier ready rooms were both briefing rooms and a place for flightsuits. The modern version on the USS *Constellation* (below) has the same work area but without the closet space.

US NAVY VIA SEA AIR OPERATIONS GALLERY COLLECTION/NASM ACC. NO. 1995-0040

Ready rooms have long filled that secondary role. "It was a place to go and just shoot the breeze," recalls Kenneth Schechter, who flew A-1 Skyraiders from the carrier *Valley Forge* during the Korean War. "The ready room had some blackboards and notices and all sorts of dire warnings, maps of where enemy aircraft guns were placed. You had your flight gear in there, so you'd get dressed in the ready room. And there were happy mottos in chalk. 'Be a good boy, be of good faith.' "

One of the biggest differences in ready rooms today is e-mail connectivity. How will ready rooms change in another 50 years? "I think that the briefings and even the social aspect will be very similar," says Troyer. "The ready room is the heart of the squadron and that will be the same— at least if we're still flying manned aircraft."

■■■ ROGER A. MOLA

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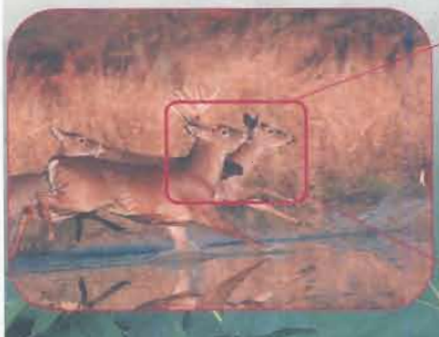

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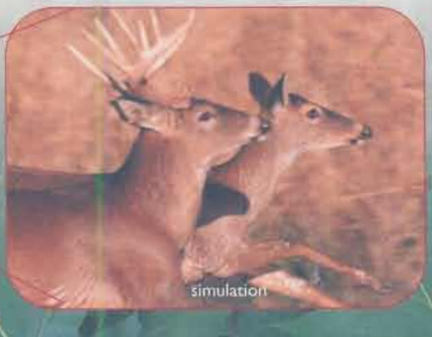

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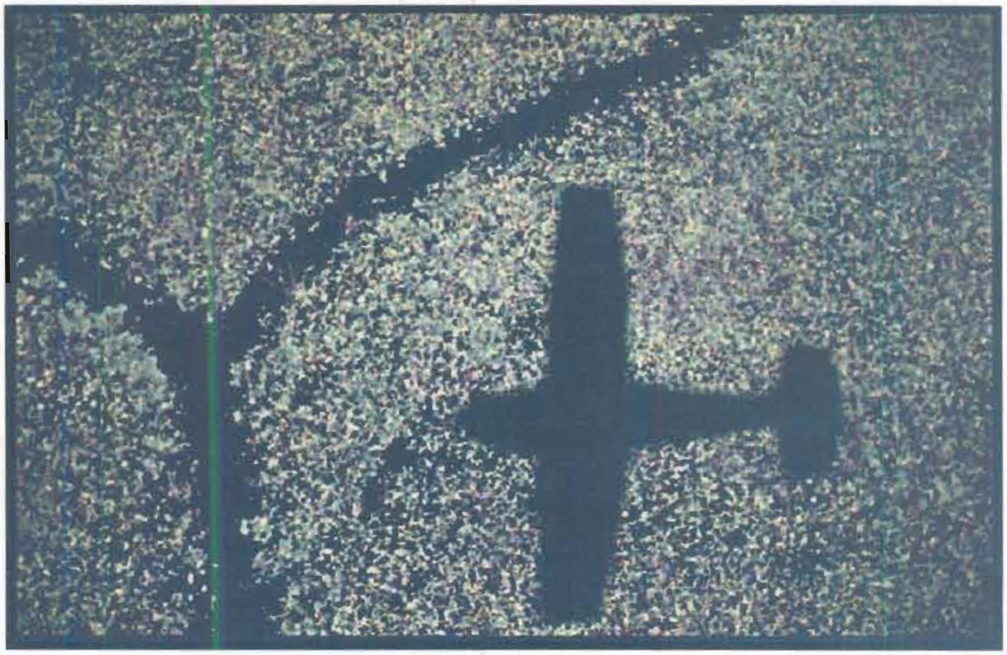
Flying on the Edge

Scott Griffin piloted his Cessna 180 around Africa for two years – and lived to tell the tale.



The shadow of the author's Cessna 180 passes over the Luala River Delta.

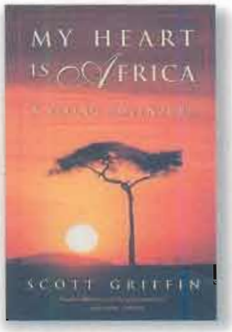
SCOTT GRIFFIN

My Heart Is Africa: A Flying Adventure

by Scott Griffin. House of Anansi Press, 2006. 296 pp., $16.95.

In 1996, a Canadian entrepreneur, Scott Griffin, went to Africa to help the Flying Doctors Service clean up its act. The service was ill-organized, and it had squandered much of its financial support. Griffin helped get the organization under the shelter of the more efficient African Medical and Research Foundation. At the same time, Griffin and his wife spent two years flying around Africa in their Cessna 180, in which he had soloed across the Atlantic.

His book is more an account of nightlife in cities from Nairobi to Cape Town, of drinking Tusker beer with other non-governmental types, than it is a conventional portrayal of safari country and wildlife. Griffin's graceful and observant writing also gives many a hint that he's one of those strong, self-made men who bull their way through aviation rather than caressing the craft of flying, so his time in Africa is fraught with drama.



Not only does he cross the Atlantic with a single high-frequency radio that he isn't entirely sure how to operate, but in Kenya, he twice crashes his tail-dragger. Scariest of all, Griffin and his wife at one point cross the Kenyan border to illegally land on a remote, grassy patch in Tanzania (he admits that he knew exactly what he was doing) for a quick picnic. They're arrested by park rangers toting AK-47s, and for several days, it looks as though they'll never see their airplane—or civilization—again.

Ultimately, Griffin circumnavigates all of Africa never knowing where or whether he'll find fuel. And he recrosses the Atlantic as though it's just another trip to Toronto. His wife, more discreet, flies commercial. Pilots will be put off by the frequent clangers—a "manifold temperature" gauge? A light twin called a "Nordo"?—but *My Heart Is Africa* is a fascinating glimpse of a man who grabs adventure by the horns.

■■■ STEPHAN WILKINSON IS THE AUTHOR OF *THE GOLD-PLATED PORSCHE: HOW I SANK A SMALL FORTUNE INTO A USED CAR, AND OTHER MISADVENTURES.*

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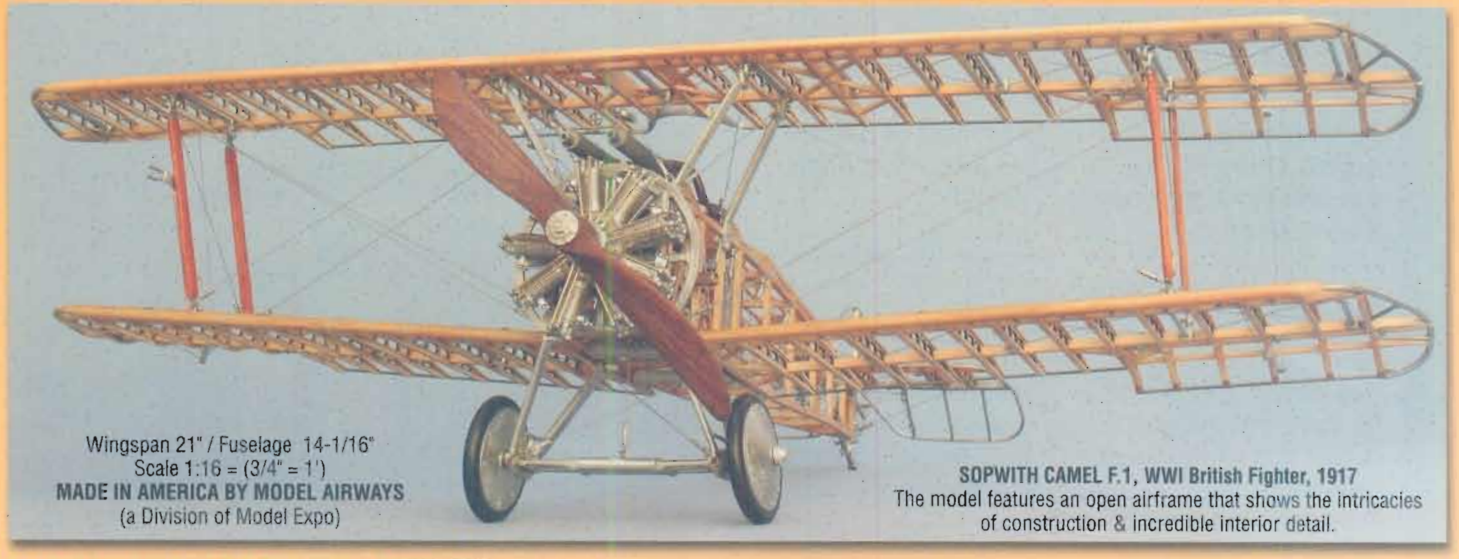

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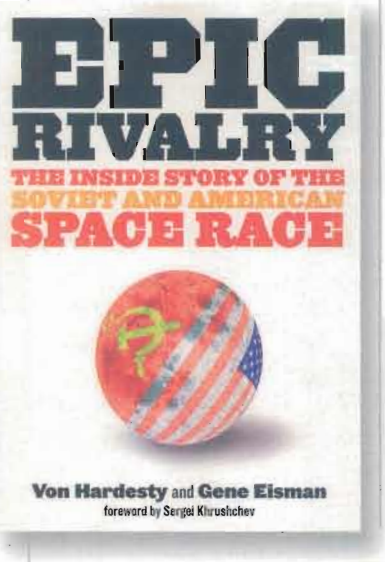
>>> At a Glance: Sputnik and the Space Age <<<

Epic Rivalry: The Inside Story of the Soviet and American Space Race

by Von Hardesty and Gene Eisman. National Geographic, 2007. 368 pp., $28.

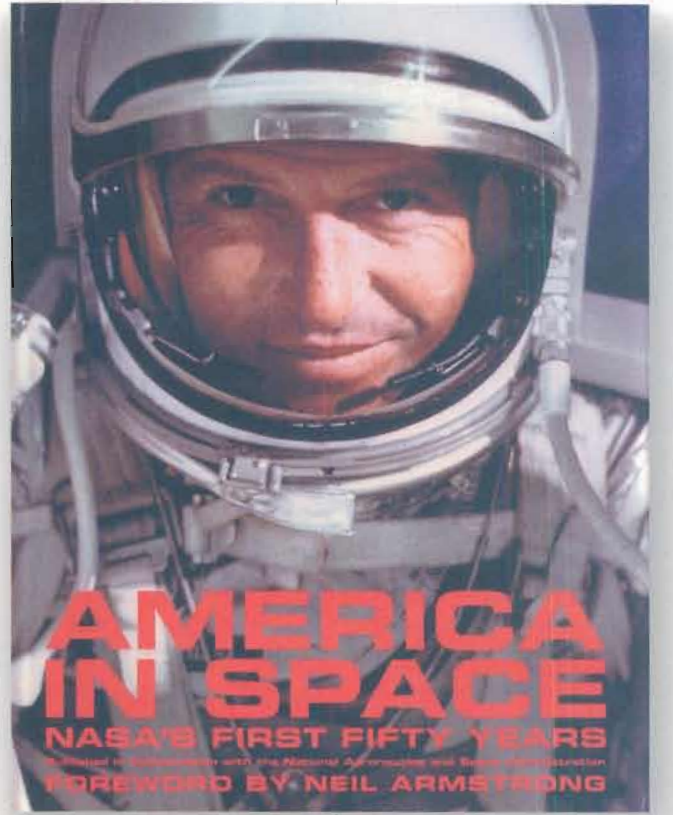
National Air and Space Museum aeronautics curator Von Hardesty and Gene Eisman have delivered a book that tells the story of the space race from both sides, documented by formerly classified U.S. and Russian sources.

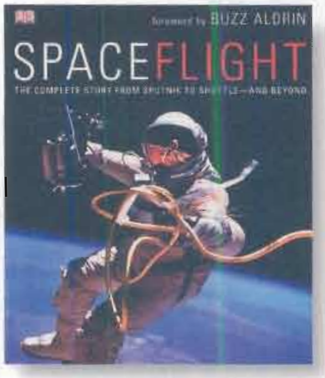

EPIC RIVALRY
THE INSIDE STORY OF THE SOVIET AND AMERICAN SPACE RACE
Von Hardesty and Gene Eisman
foreword by Sergei Khrushchev

America in Space: NASA's First Fifty Years

Published by Abrams, in collaboration with NASA, 2007. 351 pp., $50.

With hundreds of color and black-and-white images and authoritative text from NASA's archives, *America in Space* captures the human drama of the Space Age.





Spaceflight: The Complete Story From Sputnik to Shuttle – and Beyond

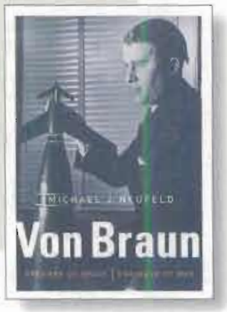
by Giles Sparrow. Dorling Kindersley, 2007. 320 pp., $40.

Illustrated by more than 850 photographs, *Spaceflight* offers a comprehensive view of space travel efforts the world over.

Von Braun: Dreamer of Space, Engineer of War

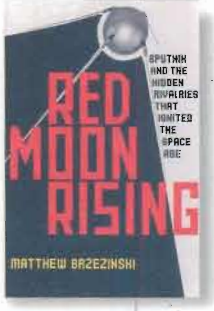
by Michael J. Neufeld. Knopf, 2007. 608 pp., $35.

National Air and Space Museum curator Michael J. Neufeld presents a thoroughly researched biography of German rocket pioneer Wernher von Braun.



Red Moon Rising: Sputnik and the Hidden Rivalries That Ignited the Space Age

by Matthew Brzezinski. Times Books, 2007. 310 pp., $26.



A former Moscow correspondent for the *Wall Street Journal*, Brzezinski takes readers inside the Kremlin and the White House as both sides struggled for supremacy aloft.

A History of the Kennedy Space Center

by Kenneth Lipartito and Orville R. Butler. University Press of Florida, 2007. 478 pp., $39.95.

This book describes the role of Florida's Kennedy Space Center during the early years of the space race and takes readers through recent times by discussing the loss of the space shuttle *Columbia*.

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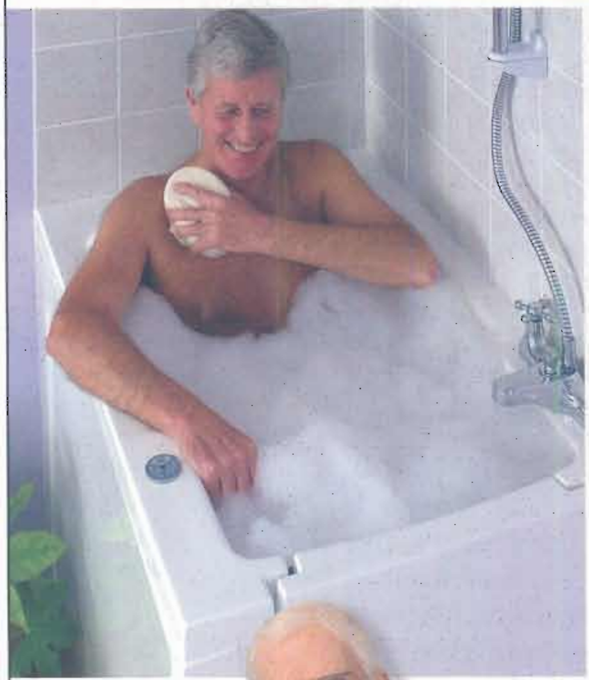

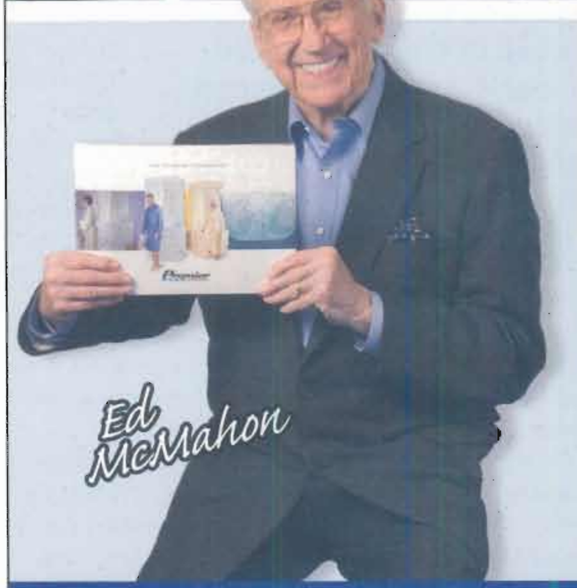

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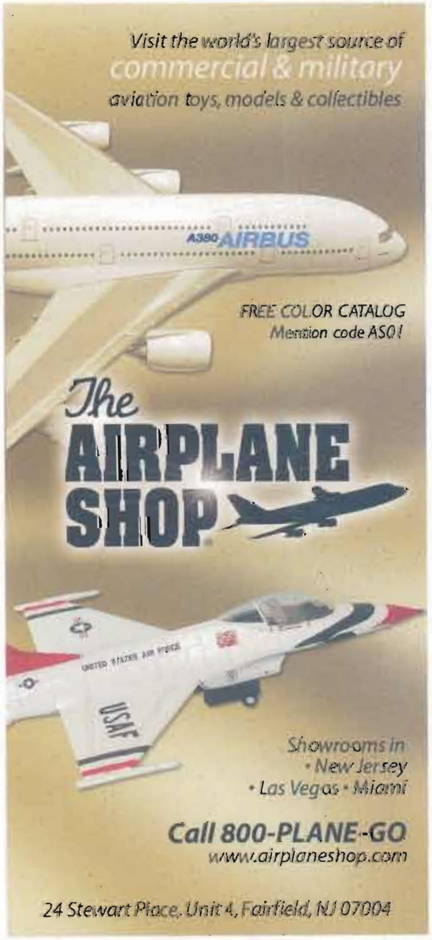
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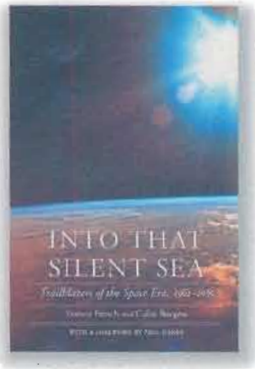
Into That Silent Sea: Trailblazers of the Space Era, 1961–1965

by Francis French and Colin Burgess. University of Nebraska Press, 2007. 402 pp., $29.95.

Will we ever feel as though we really know the first astronauts and cosmonauts—the "trailblazers" of the book's title? The question lingers over this eminently readable, well-crafted contribution to the burgeoning genre of first-person accounts and popular histories of space explorers.

The appetite for more on the early space explorers persists even though the documentation on the early Space Age is already rich. These explorers, like no other figures in modern history, have become symbols of our attempt to understand the changes of the post-World War II world—to men, women, science, technology, geopolitics, and humanity's relation to nature. It is a quest that is never quite complete.



Authors Francis French and Colin Burgess see the large questions but keep the focus tightly on the explorers. They explicitly resist presenting their subjects as heroic but flawed demigods (as Tom Wolfe did in *The Right Stuff*) or as "cogs in the machine" of technological gigantism and cold war politics (Norman Mailer's interpretation in *Of a Fire on the Moon*). Rather, the authors aim for a modest populism. The explorers might best be seen, they suggest, as down-to-earth working folks. Gifted, driven, and "in the right place, at the right time," yes, but what defines them is their dedication to craft and their integrity. This angle yields the book's strength: Ten chapters of biographical sketches, roughly alternating between cosmonauts and astronauts. The book begins with Yuri Gagarin and ends with Alexei Leonov, the first space walker.

> **These explorers, like no other figures in modern history, have become symbols of our attempt to understand the changes of the post-World War II world – to men, women, science, technology, geopolitics, and humanity's relation to nature. It is a quest that is never quite complete.**

The populist idea proves useful in other ways. It leads the authors to include the tangled story of the "Mercury 13" women as seen through a vignette on pilot Wally Funk, and the recounting complements the way the writers treat cosmonaut Valentina Tereshkova. Without belaboring it, the authors point out that our notions of exploration are gender-tinged. Gender and the working-level view are sometimes combined: Dee O'Hara, nurse for the Mercury 7, recalled that a few hours after Alan Shepard's historic flight, she and he sat in a bar on Grand Bahama Island. Shepard puffed on her cigarette and sipped her scotch and water as they watched the evening news extol his wholesome virtues.

The merits of this popular history rest in the elegant narrative and the authors' thoughtful awareness of the space explorer genre. This volume precedes a companion book that will cover the years 1965 to 1969. If that one possesses the same qualities as *Into That Silent Sea*, the authors will have provided general readers a fine entrée into the Space Age.

■■■ MARTIN COLLINS IS A CURATOR AT THE NATIONAL AIR AND SPACE MUSEUM'S DIVISION OF SPACE HISTORY.

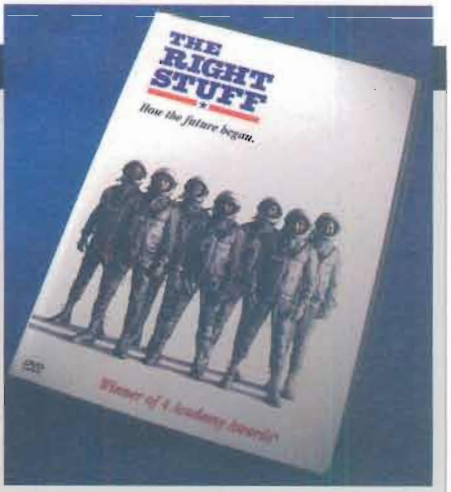
The Right Stuff

DVD. Rated PG. Warner Home Video, 1997. $14.98.

It's been more than 20 years since *The Right Stuff* premiered in 1983, but the film is just as much fun to watch now as it was then. Based on the Tom Wolfe book with the same title, *The Right Stuff* tells the real-life story of America's hottest test pilots and the Mercury 7 astronauts.

A terrific screenplay, fine acting, and beautiful cinematography all make for great movie-making. The flying scenes, whether in an experimental aircraft or a space capsule, are good, but the best scene in the movie takes place on the ground: U.S. Air Force pilot Chuck Yeager, played by Sam Shepard, rides on horseback through California's high desert the day before his October 14, 1947 sound-barrier-breaking flight. Coming to the top of a scrub-covered ridge in the late afternoon, he looks down to see the orange Bell X-1 hooked up to a fuel truck parked on a dry lakebed. No technicians are visible as the X-1's rocket engine undergoes a test run, flames pouring out of the nozzles. The tension in Yeager's face as he studies the sight reminds us that a test pilot's triumph could turn to tragedy at any second.

The film also portrays the human dramas behind the aerial record-setting: An angry John Glenn, perfectly played by Ed Harris, chastises his fellow astronauts for fooling around with young groupies. "Mr. Glenn, you are way out of line," counters Alan Shepard. "As long as a man uses good sense, what he does with his zipper or his wick is his own business." There's also the awful moment when Glenn's wife, Annie, who has a stutter, repeatedly rejects Vice President Lyndon Johnson's attempts to speak with her in the minutes leading up to her husband's first launch attempt. Part of you sympathizes with her, but part of you wants her to buck up and play the part of the Astronaut Wife.

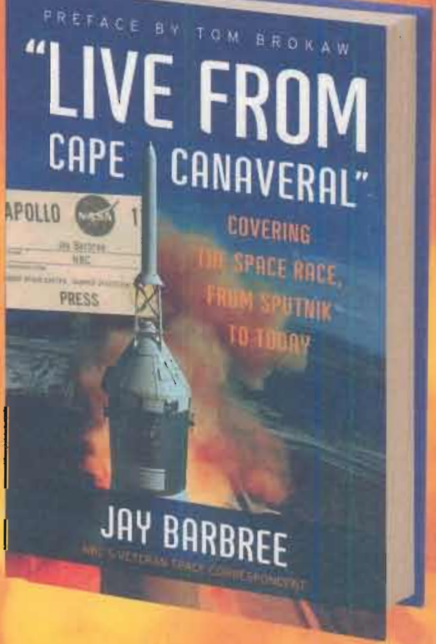


The film is not flawless: An overwrought score horns in on the scene of Yeager breaking the sound barrier; surely the majesty of the moment should have stood on its own.

Still, *The Right Stuff* is a classic. If you don't have it in your collection, get it—and watch it every October 14.

DIANE TEDESCHI IS AN *AIR & SPACE* ASSOCIATE EDITOR.

"JAY BARBREE . . . IS ARGUABLY THE BEST CORRESPONDENT TO EVER COVER THE SPACE PROGRAM." —LARRY KING, *USA TODAY*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—John Glenn, First American Astronaut in Orbit

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Forecast

IN THE WINGS AND ON THE WEB...

IN THE NEXT ISSUE

THE WORLD OF AEROSPACE is as diverse as the imaginations of those who design, build, fix, and dream about all things that fly, soar, or blast off. Doubters should check out the December issue, where such a great variety of flying things are represented.

F-117A stealth fighters
HOLLOMAN AIR FORCE BASE

Goodnight, Nighthawk Accomplished military journalist Bill Sweetman assesses the retiring F-117A stealth fighter and compares the promise of its stealth engineering to its actual career.

Breezy Ambassador Oshkosh, Wisconsin fly-in fixture Carl Unger loves his open-fuselage airplane. He wants everyone else to love it as well – to the benefit of movie stars, politicians, and any Joe Q. Public who wants a joyride.

Concorde Centerfold A lavish photo essay explores new angles of a beautiful, doomed celebrity aircraft: The Mach 2 Concorde.

The Breezy homebuilt
GRANT/DCP, INC.

Vertical Road Trip Bigelow Aerospace, the outfit that wants to bring inflatable hotels to Earth orbit, is working on the rocket flights to get guests up there.

On the Web

Remember to check out ***www.airspacemag.com*** for additional material related to the magazine articles, as well as exclusive features, interviews, and columns. From space shuttle guides to discussions with influential figures in aviation, the Web site is a must-read for aerospace aficionados. Among the supplements to this month's edition are videos of the aircraft operating from Al Asad Air Base in Iraq. Ed Darack, perched near the open rear ramp on a C-130J refueler, captured video footage of his flights, providing his nose-to-nose view of approaching F/A-18 Hornets in seldom-seen footage from the air war over Iraq.

>>> Credits <<<

Sucked Up. Ewa "Birdy" Wisnierska continues to compete in paragliding. "I cannot stop flying," she says.

Unhappy Campers. William Childress says this is approximately his 6,000th magazine article in 49 years of writing; pretty soon he's going to quit.

Air War Iraq. Over the past few years, writer and photographer Ed Darack has been chronicling U.S. Marine Corps operations.

The Soplata Airplane Sanctuary. Wally Soplata spent most of his U.S. Air Force career as an instructor pilot, teaching in T-37s, T-38s, and C-141s. He now flies for a major cargo airline and lives in Collierville, Tennessee, with his wife and two children.

The O Prize. Michael Belfiore, who lives in Woodstock, New York, has written for numerous publications, including *Popular Science*.

The Real X-Men. Peter Garrison is a frequent *Air & Space/Smithsonian* contributor.

Further reading: *Hypersonic: The Story of the North American X-15*, Dennis R. Jenkins and Tony R. Landis, Specialty Press, 2003.

The Need for Speed. Patricia Trenner is an *Air & Space* senior editor.

The Man Behind the Curtain. Asif Siddiqi is an assistant professor of history at Fordham University in New York City.

How Things Work: Evacuation Slides. So far, Mark Huber has always exited aircraft through disarmed doors.

Hollywood's Favorite Pilot. Stephen Joiner, a frequent contributor to *Air & Space*, writes about aviation from his home in southern California. He wrote "Calling All Mustangs," the cover story for the August 2007 issue.

Pre-Flight and After Hours. Roger A. Mola is *Air & Space*'s researcher.

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The Third Generation

WHEN BOEING ROLLED out the 787 on July 8 for the world to see, the debut marked a milestone that has been widely heralded. The airplane is the first commercial aircraft with its primary structure made of composite materials instead of aluminum alloy. Composites embed strong fibers, arranged to carry loads, in a surrounding plastic. One of the earliest composites is fiberglass, which today is used in everything from canoes to cars.

What has gone largely unnoticed is that the 787 marks only the second time the structural materials used to build commercial airliners have changed. Most first-generation airliners were built of wood, which is light and strong. And, because wood is really a matrix of cellulose fibers, it's rather like a composite. That material would be abandoned after an event on March 31, 1931, when Transcontinental & Western Air Flight 3, a Fokker F-10A Tri-Motor, departed Kansas City, Missouri, for Los Angeles, California. Aboard was 43-year-old Knute Kenneth Rockne, who had been head coach of Notre Dame's football team for 13 years. Near Bazaar, Kansas, one of the F-10's wings separated from the fuselage and the aircraft plunged to the ground, killing all aboard.

The death of Rockne, a national icon, shocked the country and may have fed a sense of urgency in the investigation that followed. Experts determined that moisture had seeped into the wood and loosened some glue, and a strut had eventually come loose, leading to catastrophic flutter and the separation of the wing. The Fokker fleet was temporarily grounded, and the flying public as well as the U.S. Department of Commerce began to question whether wooden aircraft were safe.

Aluminum alloy of the type already in use on the Ford Tri-Motor had none of the drawbacks that had led to the crash of TWA 3, and with the advent of the Boeing 247 and Douglas DC series, all-metal airplanes became the standard. Not that metal didn't have its problems: A series of crashes of de Havilland Comet jetliners in 1954 led to the discovery of metal fatigue, the failure of metal after it is repeatedly strained, such as when a can lid is flexed until it breaks. More recently, spectacular structural failures in jetliners such as Aloha Airlines Flight 243, a Boeing 737 that in 1988 lost a large section of its cabin while in flight, illuminated the sensitivity of metal structure to corrosion and other effects of aging.

The companies that build airliners don't make such fundamental changes often. Boeing decided to build the 787 out of composites only after the aerospace industry had acquired long experience with these materials in aircraft. The composites promise to save the airlines money and virtually eliminate worries about fatigue and corrosion. The pace of change may seem slow, but maybe two changes in a hundred years is about right.

GEORGE C. LARSON, MEMBER, NAA

Whippersnapper and Grandpa: Boeing's new 787 shares structural DNA with the wood-and-fabric Fokker F-10A (inset).

LEFT: BOEINGMEDIA.COM; INSET: NASM (SI NEG. #A-4140)

VISIT THE NAA WEB SITE AT WWW.NAA.AERO OR CALL (703) 527-0226.